A-Level Computer Science Revision Question Pack  Mark Schemes

If you are struggling to find your question use “**FIND”**  ans serach for the questions number followed by a full stop.

**1.** (a) Client workstation computers ;

are provided with a service from some central server ;

all processing required is done by the server ;

the processing results are then returned to the client ; Max 3

(b) (i) Set of rules about the way two devices communicate ; 1

(ii) Alice uses SMTP to send her message;

to the e-mail server of her ISP;

The ISP looks at the Domain Name to find the servers accepting  
messages for that domain ;

The Domain Name is (the second) part of the destination address;

The message is delivered to the mail box of the user;

Bob logs on through the Internet to his ISP;

and collects his message using POP3; Max 5

**4-5 marks** Candidate has provided a detailed explanation of how Alice’s  
 message can be picked up with reference to the main protocols  
 involved demonstrating a clear understanding of this subject area.

Text is legible.

There are few, if any, errors of spelling, punctuation and grammar.

Meaning is clear.

The candidate has selected and used a form and style of writing  
appropriate to purpose and has expressed ideas clearly and fluently.

Sentences and paragraphs follow on from one another clearly and  
coherently.

Appropriate, specialist vocabulary has been used.

**2-3 marks** Candidate has provided a limited explanation of how Alice’s message  
 can be picked up with reference to some of the main protocols involved,  
 demonstrating some understanding of this subject area.

Text is legible.

There may be occasional errors of spelling, punctuation and grammar.

Meaning is clear.

The candidate has, in the main, used a form and style of writing which  
is appropriate for its purpose, with occasional lapses.

The candidate has expressed ideas clearly and reasonably fluently.  
Candidate has used well-linked sentences and paragraphs. Information  
or arguments are generally relevant and well structured.

**1 mark** Candidate has provided a weak explanation which does not demonstrate  
 a clear understanding of the main protocols involved. Information may  
 sometimes stray from the point or information be weakly presented and  
 not be fluent.

There may be some errors of spelling, punctuation and grammar.

The candidate has used a form and style of writing which has many  
deficiencies.

Sentences and paragraphs may not always be well-connected.

[9]

**2.** (a) 1. A

2. C

3. B 1

(b) Start at first item; and examine each succeeding item in turn;

Until item is found; or the end of the list reached;

**A** algorithm max 3

O(n) as up to n items searched;

All items may be searched; max 1

(c) For each succeeding pair of items;

if they are out of sequence they are swapped;

the process is repeated;

up to n-1 times; or until no more swaps are made;

max 3

All n items are compared up to n-1 times;

1

[9]

**3.** (a) (i)



1

(ii)



1

(iii)



1

(b) (i) A calculation; results in a value that is too near 0 to be stored;

**R** too small without clarification 2

(ii) A small number is divided by a very large number//

Two small numbers are multiplied together//

Or by example; 1

[6]

**4.** (a)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |  |
| 1 | 0 | 1 | 1 | 0 | ; |
| 2 | 0 | 0 | 0 | 1 | ; |
| 3 | 0 | 1 | 0 | 1 | ; |
| 4 | 0 | 0 | 0 | 0 | ; |

or

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 |
| 1 | 0 | 0 | 0 | 0 |
| 2 | 1 | 0 | 1 | 0 |
| 3 | 1 | 0 | 0 | 1 |
| 4 | 0 | 1 | 1 | 0 |
|  | ; | ; | ; | ; |

max 3

(b) (i) Max size only limited by memory;

Only uses memory it requires; max 1

(ii) No pointers required; 1

(c) (i) Adjacency Matrix; 1

(ii) Faster to insert/delete; fixed size; 2

[8]

**5.** (a) Table contains partial dependencies;

Or any of SupplierName, SupplierAddress, SupplierTelNo depend upon  
SupplierID 1

(b) *1 mark for primary key, 1 mark for correct other attributes*

(i) CoinID VARCHAR(8) PRIMARY KEY(NOT NULL)//  
CoinID VARCHAR(8) PRIMARY KEY(CoinID);



SupplierID Int ;

**A** any sensible types 2

(ii) SupplierID VARCHAR(8) PRIMARY KEY(NOT NULL)//

SupplierID VARCHAR(8) PRIMARY KEY(Suppliers ID);

 1

(c)



1

(d) SELECT Type, Year, Condition, PricePaid

FROM Coin, Supplier;

WHERE Coin.SupplierID = Supplier.SupplierID;

ORDER BY PricePaid;

*OR*

SELECT Type, Year, Condition, PricePaid

FROM Coin INNER JOIN Supplier; ON

Coin.SupplierID = Supplier.SupplierID;

ORDER BY PricePaid; 3

[8]

**6.** (a) A 192.71.0.1; **A** any valid number instead of 1

B 192.71.0.2; **A** any valid number instead of 2

C 192.71.1.1; **A** any valid number instead of 1 3

(b) To block access to/from the internal network from/to the Internet;

To stop/limit/block/restrict certain kinds of access to the web server,  
e.g. telnet;

To close ports to prevent users from connecting to them//

To block connections on unwanted ports;

To prevent unauthorised access to the private computers;

**A** Filtering

**R** To stop hackers NE Max 5

**4-5 marks** Candidate has provided a detailed explanation with clear  
 reference to the role of ports and at least two functions  
 performed by the firewall, taken from the list above.

Text is legible.

There are few, if any, errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has selected and used a form and style of  
writing appropriate to purpose and has expressed ideas clearly  
and fluently.

Sentences and paragraphs follow on from one another clearly  
and coherently.

Appropriate, specialist vocabulary has been used.

**2-3 marks** Candidate has provided an explanation with limited reference  
 to the role of ports and no more than two functions performed  
 by the firewall, taken from the list above.

Text is legible.

There may be occasional errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has, in the main, used a form and style of writing  
which is appropriate for its purpose, with occasional lapses.

The candidate has expressed ideas clearly and reasonably  
fluently.

Candidate has used well-linked sentences and paragraphs.  
Information or arguments are generally relevant and well  
structured.

**1 mark** Candidate has provided a weak explanation with no, or very  
 limited, reference to either the role of ports or functions  
 performed by the firewall.

The candidate does not demonstrate a clear understanding  
of the purpose of a firewall.

Information may sometimes stray from the point or  
information be weakly presented and not be fluent.

There may be some errors of spelling, punctuation and  
grammar.

The candidate has used a form and style of writing which has  
many deficiencies.

Sentences and paragraphs may not always be well-connected.

(c) Converting/transforming from plain text into ciphertext/secret code;

**A** scrambled

**A** transposition/conversion

The sender processes the data prior to the transmission so that if it is  
accidentally or deliberately intercepted while it is being transferred it  
will be incomprehensible to the intercepting party; Max 4

**4 marks** Candidate has provided a clear description of encryption and  
 explanation of why it is used, with reference to the list above.

Text is legible.

There are few, if any, errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has selected and used a form and style of  
writing appropriate to purpose and has expressed ideas  
clearly and fluently.

Sentences and paragraphs follow on from one another  
clearly and coherently.

Appropriate, specialist vocabulary has been used.

**3 marks** Candidate has provided a limited description of encryption  
 and explanation of why it is used, with reference to some  
 of the points listed above.

Text is legible.

There may be occasional errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has, in the main, used a form and style of  
writing which is appropriate for its purpose, with occasional  
lapses.

The candidate has expressed ideas clearly and reasonably  
fluently

Candidate has used well-linked sentences and paragraphs.

Appropriate, specialist vocabulary has been used.

**2 marks** Candidate has provided a very limited description of  
 encryption and explanation of why it is used, with reference  
 to few of the points listed above, or has not provided a  
 description or explanation.

Text is legible.

There may be some errors of spelling, punctuation and  
grammar, but not such as to cause problems in the reader’s  
understanding and not such as to suggest a weakness in these  
areas.

The candidate has used a form and style of writing which is  
sometimes appropriate to its purpose, but with many  
deficiencies.

The candidate has expressed straightforward ideas clearly, if  
not always fluently.

Sentences and paragraphs may not always be well-connected.  
Information may sometimes stray from the point or be weakly  
presented.

**1 mark** Candidate has not provided a description and/or explanation  
 of encryption and has made limited reference to the points  
 listed above which demonstrates a lack of understanding of  
 this subject area.

Text is legible.

There are many errors of spelling, punctuation and grammar,  
which suggests a weakness in these areas.

The candidate has used a form and style of writing which has  
many deficiencies.

(d) (i) B’s public key; 1

(ii) B’s private key; 1

[14]

**7.** (a) (i) 1 mark for correctly positioned arrow, ignore data on tape



1

(ii) 1; 1

(b) 2 marks for correct tape symbols, 1 mark for correct position of arrow



3

(c) 3 + 1 or the successor to 3; 1

[6]

**8.** (a)

|  |  |  |
| --- | --- | --- |
|  | Expression | Yes/No |
| 1 | 4 \* 9 | Yes; |
| 2 | 8 + 6 / 2 | Yes; |
| 3 |  6 \* 2 | No; |
| 4 | (4 + 5) \* 5 | No; |

4

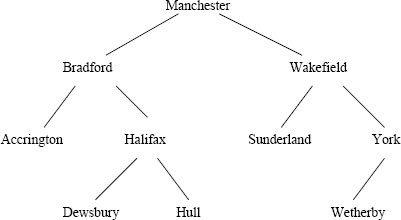
(b) (i) 5 6 2 ;\*; +; 2

(ii) No Brackets;

Easy to Compute; 1

[7]

**9.** (a)



1 mark for Manchester

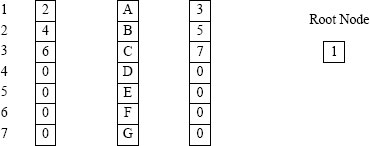
1 mark for Bradford and Wakefield

1 mark for Accrington and Halifax

1 mark for Dewsbury and Hull

1 mark for Sunderland, York and Wetherby 5

(b)



1 mark for each correct array, 1 mark for index 1..7, 1 mark for root  
node pointer with value 1. 5

(c)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Call No | TreeNodePtr | Output in chronological order | | | | | | |
|  |  | First | Second | Third | Fourth | Fifth | Sixth | Seventh |
| 1 | 1 |  |  |  | A |  |  |  |
| 2 | 2 |  | B |  |  |  |  |  |
| 3 | 4 |  |  |  |  |  |  |  |
| 4 | 0 | D |  |  |  |  |  |  |
| 5 | 5 |  |  |  |  |  |  |  |
| 6 | 0 |  |  | E |  |  |  |  |
| 7 | 3 |  |  |  |  |  |  |  |
| 8 | 6 |  |  |  |  |  | C |  |
| 9 | 0 |  |  |  |  | F |  |  |
| 10 | 7 |  |  |  |  |  |  |  |
| 11 | 0 |  |  |  |  |  |  | G |

1 mark for 2,4; 1 mark for 0,5,0; 1 mark for 3,6,0 1 mark for 7,0

1 mark for each of D,B,E,A,F,C,G in correct column 11

(d) Inorder; 1

[22]

**10.** (a) Any three @ one each

Procedure calls itself;

Base case enables escape from recursion;

System keeps pending calls on a stack;

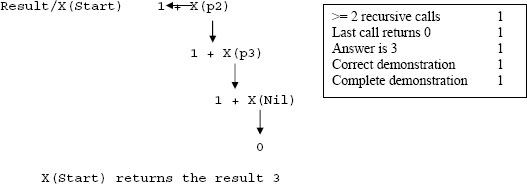
Parameters also passed on a stack;

Need a stack;

System needs a lot of memory to handle recursion;

Recursive programs are usually shorter than their non-recursive  
equivalents; 3

(b)



5

(c) X returns a count; of the number of nodes in the list; 2

(d) Procedure Y(Item) parameter 1

If (Item <> Nil) 1

Then Y(Item.Ptr) 1

Print (Item.Data) 1

EndProcedure

To print whole list in reverse order call Y(Start) 1 5

(e) Non-recursive solutions may

Store data part in nodes in an array

Until Nil found;

Then print output array in reverse order;

Problem is length of list is not known in advance;

Recursive solution fails in the event of stack overflow or running  
out of memory;

Non-recursive solution is easy if each node includes a back pointer  
to the previous node and a separate pointer to the tail of the list is  
maintained;

Follow forward pointers to end then follow backward pointers to  
beginning and print; Max 5

**4-5 marks** Candidate has provided a detailed discussion to the problem,  
 with a clear explanation with reference to many of the points  
 listed above which demonstrates a clear understanding of this  
 aspect of the subject.

Text is legible.

There are few, if any, errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has selected and used a form and style of  
writing appropriate to purpose and has expressed ideas  
clearly and fluently.

Sentences and paragraphs follow on from one another  
clearly and coherently.

Appropriate, specialist vocabulary has been used.

**2-3 marks** Candidate has provided an explanation with limited reference  
 to the problem which demonstrates a lack of understanding  
 in some aspects of this subject area. .

Text is legible.

There may be occasional errors of spelling, punctuation and  
grammar.

Meaning is clear.

The candidate has, in the main, used a form and style of  
writing which is appropriate for its purpose, with occasional  
lapses.

The candidate has expressed ideas clearly and reasonably  
fluently. Candidate has used well-linked sentences and  
paragraphs. Information or arguments are generally relevant  
and well structured.

**1 mark** Candidate has provided a weak explanation which does not  
 demonstrate a clear understanding of this subject area.

Information may sometimes stray from the point or be  
weakly presented and not be fluent.

There may be some errors of spelling, punctuation and  
grammar.

The candidate has used a form and style of writing which  
has many deficiencies.

Sentences and paragraphs may not always be  
well-connected.

[20]

**11.** (a) Bits are sent along a single wire/line; bits are sent one after another;

**R**. Bits of (the) data Max 1

(b) (i) Data bit; Max 2

Parity (bit);

Signal to start data transfer/strobe;

Signal ‘ready to receive data’ / busy;

Signal to acknowledge data transfer / Complete;

Out of paper/ink / error;

On-line/off-line;

Handshaking //control signal/status signal (BUT only if not by

example above);

Ground;

(ii) Transmission over long distances;

When a high data transfer rate is required; Max 1

**A.** No driver is available;

(c) Data is transmitted intermittently (rather than as a steady stream);

Sender and receiver are only synchronized when data is being sent // start  
bit synchronises the receiver;

**R.** Description only of start and stop bits 1

[5]

**12.** (a)



Correct root + left subtree;

Correct root + right subtree;

**I.** identification of PollardJ as the root

**A.** a complete ‘left-right’ mirrored image. 2

(b) (i) PollardJ, AtkinsP, CollinsK 1

from a correctly drawn left sub-tree;

(ii) 4 from a correctly drawn right sub-tree; 1

[4]

**13.** (a) 2-D array; 1

(b) Shows that sales person 2; did meet their target; for Quarter 3 /  
July- September; Max 1

(c)



NewArray initial values all 0; 1

Person loop counter 1 to 3; 1

Person 1 - is followed by quarters 1 to 4 in sequence; 1

NewArray[2] = 1 for person = 1 and Quarter = 2; 1

Final NewArray[1] = 2; 1

Final NewArray[2 and 3 and 4] values are correct; 1

(d) Stores the (total) number of sales staff who did not meet their target // the 2  
(total) number of sales targets not met;

for each quarter;

[10]

**14.** (a) (i) Interactive; 1

(ii) Real Time; 1

(iii) Network; 1

(b) (i) Batch; 1

(ii) Interactive; 1

(iii) Real Time; 1

[6]

**15.** (a) a collection of tables /more than one table; 1

//two or more linked tables / referencing other tables;

(b) (i) two (or more) attributes **R** keys which are jointly used to uniquely 1  
identify a record / tuple / row;

(ii) because no one attribute can uniquely identify a record in this relation; 1

**A** field

// answer in context of Booking table

(c) (i) an attribute in one relation/table which (links to)/is a primary key 1  
attribute in another relation / table; **A** field

(ii) CatOwnerID; 1

(d) 4

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Field | CageNumber | CatName | Surname | ContactNumber |
| Table | Booking | Cat | CatOwner | CatOwner |
| Criteria | 9 |  |  |  |
|  | ; | ; | ; | ; |

**A**[enter cage number]

*or similar*

Order unimportant; **I** other fields if they don’t inhibit the QBE;

A If Ginger entered for criterion for Cat

*Table e.g. Cat Table, Penalise once*

*Ignore anything written BELOW the grid*

[9]

**16.** (a) Process requires service from a resource;

Process is timed out// Time slice expires;

Process is pre-empted; Max 2

(b) Priority queue; 1

[3]

**17.** (a)



1 mark for correct boxes

1 mark for correct lines

1 mark for correct line endings 3

(b) Loan = class

Public

Procedure CreateLoan

Procedure DeleteLoan

Procedure GetLoanDetails;

Private

Person: Borrower

BookLoaned: BookCopy;

DateOfLoan: Time/Date **A** string

ReturnDate: Time/Date; **A** string

End;

1 mark for Loan = Class + Public + Private + End

1 mark for CreateLoan + DeleteLoan + GetLoanDetails

1 mark for Person + BookLoaned

1 mark for DateOfLoan + ReturnDate

**A** any reasonable names for operations and data items. 4

(c) Add a new data item ShortLoan; of type Boolean; **A** loanlength; integer;

**A** loantype; string;

Modify the code for the operations; Max 2

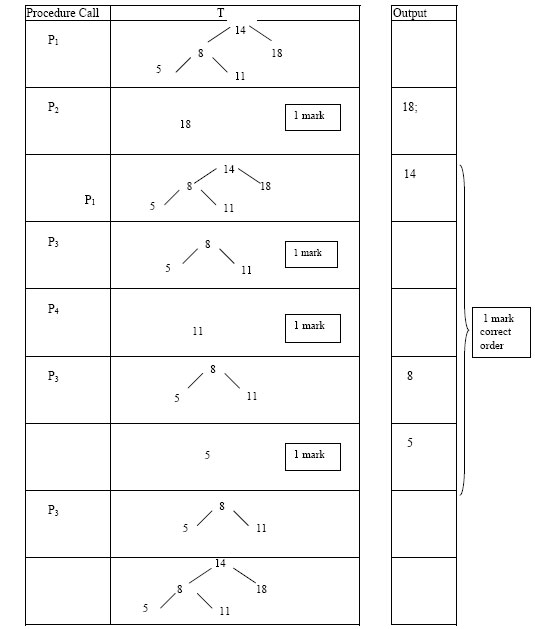
[9]

**18.** (a) a procedure/routine that calls itself/ is defined in terms of itself;

**A** Function instead of procedure

**R** re-entrant **R** program **R** iteration 1

(b) (i)



6

(ii) Reverse Inorder// Reverse order; (tree) traversal; 2

[9]

**19.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (a) | (i) | ***single word answers not enough***  *interview:*  ask/talk to the finance clerk how costs are charged to departments // ask the finance clerk what info is recorded in the charge book // ask the finance clerk how/when he re-orders items; | Max 1 | *Must say who is being interviewed*  *Accept interviewing* *teachers with details as for* *(ii)*  *Do not accept general descriptions such as ‘what* *he likes about the system’* |

|  |  |  |  |
| --- | --- | --- | --- |
| (ii) | ***single word answers not enough***  *survey:* survey teachers to find out what they like/dislike about the method of recording items; survey teachers whether the items they want are always in stock; survey suppliers for delivery times / availability / current prices; | Max 1 | *General responses such as ‘survey teachers to find out how they use the system’ is not enough. The question* *is giving them the general so candidates need to be specific.*  *Surveying users is also too general* |

|  |  |  |  |
| --- | --- | --- | --- |
| (iii) | ***single word answers not enough***  *paperwork:* examine/look at/read/analyse the charge book to see what/how data is recorded; check the way the costs are charged to the departments;  work out volumetrics | Max 1 | *Do not accept general comments. Accept other* *terms for ‘charge book’ eg order forms, record book, charge sheet* |

|  |  |  |  |
| --- | --- | --- | --- |
| (iv) | ***single word answers not enough***  *observation:* watch how teachers take items and fill in the charge book; watch how the finance clerk charges each department at the end of the month; watch how the finance clerk orders new supplies; | Max 1 | *Do not accept general comments. Accept other* *terms for ‘charge book’ eg order forms, record book Accept Fred/he instead of finance clerk* |

(b) (i) A: Charge Book; 1

(ii) B: Item Description, Quantity (taken), Dept Code, (DateTaken); 1

(iii) C: Item Description, Quantity (taken) 1

(iv) D: Stock Book; 1

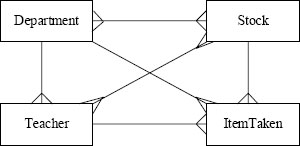
(v) E: Price List; R verb 1

(vi) F: Item Description, Quantity, (Item) Price, Total, (Dept Code); 1

I Charge Book/Form R verb

(vii) G: Item Code, Quantity, School Address/Name; A Oder Form; R 1  
verb

(c) (i)



Max 3

*1 mark per correct relationship* *I other relationships*

A  - 1 instead of ‘crow’s feet’

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (d) | (i) | Department (DeptCode, DeptName, HoDInitials);  A DeptID instead of DeptCode  R initials on its own | 1 | *Accept attribute* *names consisting of separate words/reasonable abbreviations* |

|  |  |  |  |
| --- | --- | --- | --- |
| (ii) | Teacher (TeacherInitials, FirstName, Surname, DeptCode);;  *1 mark for correct primary key and FirstName, Surname;*  *1 mark for DeptCode;* | 2 | *P1 for each extra attribute*  *Accept* *attribute* *names* *consisting of separate words/reasonable abbreviations* |

|  |  |  |  |
| --- | --- | --- | --- |
| (iii) | Stock (ItemCode, ItemDescription, ItemPrice,  QuantityInStock, OrderQuantity,MinStockLevel); | 1 | No marks if extra attributes given  *Accept* *attribute* *names* *consisting of separate* *words/*  *reasonable abbreviations* |

|  |  |  |  |
| --- | --- | --- | --- |
| (iv) | ItemTaken (TransactionNumber, ItemCode, Quantity(taken), DateTaken, TeacherInitials)  **A** *ItemCode, DateTaken,TeacherInitials as primary key*  *A TransactionID or similar;* *1 mark for an appropriate field as primary key;* *1 mark for ItemCode and Quantity; R QuantityInStock R OrderQuantity* *1 mark for DateTaken; 1 mark for TeacherInitials;*  P1 for each extra attribute | 4 | Accept other appropriate names for primary key in place of ‘Transaction Number’  *Accept attribute* *names consisting of separate words/reasonable abbreviations* |

|  |  |  |  |
| --- | --- | --- | --- |
| (e) | SELECT ItemDescription, Quantity, ItemPrice; FROM ItemTaken, Stock, Teacher;  > 30/11/2007 <1/1/2008 WHERE DateTaken>= #1/12/2007# AND DateTaken<=#31/12/2007#; AND ItemTaken.ItemCode=Stock.ItemCode; AND Teacher.TeacherInitials = ItemTaken.TeacherInitials; ORDER BY (Teacher.)DeptCode; I table name in this part only  *Alternative answer:*  *SELECT Stock.ItemDescription, ItemTaken.Quantity, Stock.UnitPrice*  *FROM (Department INNER JOIN Teacher ON Department.DeptCode = Teacher.DeptCode) INNER JOIN (Stock INNER JOIN ItemTaken ON Stock.ItemCode = ItemTaken.ItemCode) ON Teacher.TeacherInitials = ItemTaken.TeacherInitials*  *WHERE (((ItemTaken.DateTaken) Between #12/1/2005# And #12/31/2005#));*  Ignore Asc / Desc or Ascending / Descending *P1 for spurious symbols / punctuation* | 6 | *Follow* *through attribute* *names from table definitions*  *Note alternative answer:*  *For answers using INNER JOIN*  *Also note alternative date range using BETWEEN… AND …*  *Accept dates without #*  *No semicolon required at* *end of statement* |

(f) mail merge / mail merging; 1

[29]

**20.** Message/data broken down into packets; Max 3

source/destination (address) is added to each packet;

message ID added to each packet;

packet sequence number added to each packet; A numbered packet;

each packet may well travel along different paths to get to the final  
destination

// packets routed independently;

recipient puts packets into correct sequence

// packets reassembled into message at destination;

checking for errors (and resend packets)

// request for corrupted packets to be resent;

// a virtual circuit is established // packets are sent over a virtual circuit;

(allow for non-IP packet switching answers eg. X25 or ATM)

[3]

**21.** (a) acknowledge data received by the printer;

error (signal);

busy / free / ready /’status’ / acknowledge / strobe / off-line / powered  
/ switched off / out of paper;

**A**. ground / earth / return; MAX 1

**R**. Interrupt / clock

(b) (i) 110 1010; 1

(ii) 0110 1010; 1

(iii)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 8 | **0** |  | 8 | **0** |  | 8 | **0** |
| 7 | **0** |  | 7 | **1** |  | 7 | **1** |
| 6 | **1** |  | 6 | **0** |  | 6 | **1** |
| 5 | **0** |  | 5 | **1** |  | 5 | **0** |
| 4 | **1** |  | 4 | **0** |  | 4 | **1** |
| 3 | **0** |  | 3 | **1** |  | 3 | **0** |
| 2 | **1** |  | 2 | **1** |  | 2 | **1** |
| 1 | **1** |  | 1 | **0** |  | 1 | **0** |
|  | **A** |  |  | **B** |  |  | **C** |

8 parallel bits; (above, below or between the lines)

pattern A scores 2; MAX 3

pattern B scores 2;

pattern C scores 1;

(c) (i) set of rules (about the way devices communicate);

**A.** standards **R.** Instructions 1

(ii) sending signals between devices + implication of 2-way; test  
to see if the device is ready to receive /’are you ready?’;

inform device that the data has been sent / ‘here it is …’;

receiver informs the sender that the data has been MAX 2  
received / acknowledge that a transfer is completed;

(d) (i) Universal Serial Bus; 1

(ii) Line 1 used with 7/8 bits shown (above or below);

Correct code **0110 1010**; 2

(iii) The number of bits transferred per sec / per unit of time;

**I.** speed

**A.** frequency at which bits are transmitted 1

[13]

**22.** (a) (i) IP address / Internet Protocol Address; 1

(ii) Uniform Resource Locator;

**A.** Universal Resource Locator 1

(b)  Forwards / backwards / Navigation - move to a previously viewed page;

 Favourites/Bookmarks - setting up/organising/stores regularly visited  
sites;

 Options/Tools/Settings - setting up of the Home page / enable/disable  
features e.g. run JavaScript;

 Home - move to the Home page;

 Refresh - refresh the current page;

 Stop - stop loading the current page / download;

 History  show a list of the last (say) 20 pages displayed;

 Security - change settings / e.g. enable/disable graphics/pop-ups/other  
content/plug-ins;

 View HTML - source (code);

 Address bar - allows the entering of a URL/IP/web address;

 Search bar  search list for specific web site;

 RSS feeds  receiving content news/updates;

 Application launcher icon e.g. to run email client application;

**R**. HTML editor

**Feature followed by NO description scores 0**

**Good description with feature implied scores 1** MAX 2

(c) (i) footyhosting.co.uk 1

(ii) (Each hosted club has) a (sub) folder/directory containing the  
files for their site; 1

(d) 128 kbps // 2Mbps // 128 kbps AND 2Mbps;

**R**. answers where in addition any other answer is circled 1

(e) (i) (magnetic/server) hard disk/ hard drive;

**R**. removable hard disk

**A**. ‘disk’ spelt as ‘disc’ 1

(ii) 8000 GB; 1

[9]

**23.** (a) *collection of* tables / relations;

*created through* common attributes / shared attributes;

**A** common fields / shared fields

**A** primary keys and foreign keys

(must have both primary & foreign) 2

(b) (i) to uniquely identify each record  
/ to uniquely identify a particular instance of an entity;

**A** to uniquely identify a member 1

Purpose of primary key

(ii) because people can change their email addresses; 1

(iii) to speed up searching for a particular item; 1

(iv) MemberID; 1

(c) (i)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Field name | ItemOnOffer | Description | MemberID | Email address | |
| Table | Item | Item | Item /Member | Member | |
| Criterion | \* bed \* |  |  | |  |

**;;** **;** **;** **;**

\* bed \* as criterion in ItemOnOffer - i.e. correct use of wild card 2

Or: bed/ childs bed/ bunk beds, as criterion for ItemOnOffer 1

Or no criterion in ItemOnOffer when \* bed \* in Description 1

\* bed \* or \* bunk beds \* as criterion in Description 2

Or: no criterion in Description 1

MemberId, in table item / table member & no criterion 1

emailAddress in table Member & no criterion 1

Max 3

(c) (ii) 3 *(if wild card used in either ItemOnOffer or Description)*;

2 *(If \* bunk bed \* in Description)*

*1 (If criterion for ItemOnOffer ‘bed’, ‘child’s bed’ or ‘bunk beds’* 1

[10]

**24.** (a) 984; 1

(b) 984; 1

(c) (i)  13.0;;;

Allow method marks

1 mark for correctly identifying negative number

1 mark for integer value correct

1 mark for fraction (dependant on correct integer value)// 01101.000 3

(ii) To maximise precision in a given number of bits //

To minimise rounding errors;

**A** to maximise accuracy in a given number of bits 1

(iii) leftmost 2 digits/bits are different//

a significant bit is stored after the binary point//

bit after point different from bit before point;

**A** the first bit after the sign bit is a ‘0’;

**A** The second bit is a ‘0’;

**A** *an answer that clearly implies a ‘0’ follows the ‘1’* 1

(iv) 127// 27 – 1;;

Max 1 for correct mantissa (01111111) or exponent (0111/7) 2

[9]

**25.** (a) (i) Empty entries waste memory // Maximum size// fixed size; 1

(ii) Memory used by pointers//takes more time to add / delete nodes//  
indirect access takes more time; **R** programming difficulties 1

(b) Place next item in first location/ location 0/ location 1//

Implement a circular array/queue // allow wraparound; 1

(c) IsFull/IsQueueFull; 1

[4]

**26.** (a) Address of page in memory// memory frame address// physical  
address of page// Base address of page;

Page in memory or on disk// page in or out of memory// valid/invalid bit;

Dirty/ modified Bit;

Last time accessed; Max 2

(b) Page table is accessed using the page number as an index;

Address found in page table; is added; to the offset; Max 3

(c) In cache memory// associative memory/storage//

content-addressable memory/ storage// in main memory;

Each executive process needs to be able to access its physical pages//  
needs to be accessed very quickly //

Used every time memory is accessed; Max 2

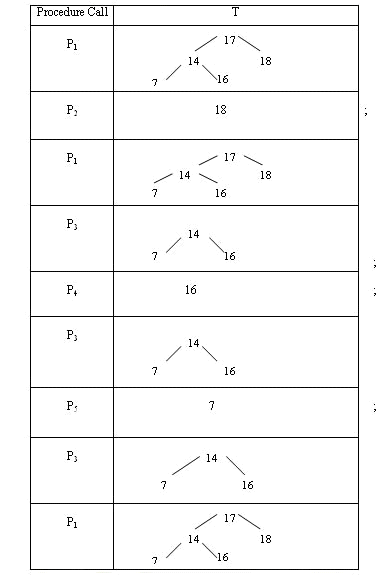
[7]

**27.** (a) a procedure/routine that calls itself/ is defined in terms of itself;

**A** Function instead of procedure

**R** re-entrant **R** program iteration (TO) 1

(b) (i) 7



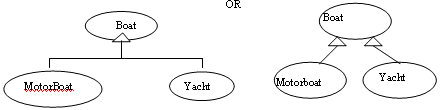
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Output | 18; | 17; | 16 | 14 | 7; |

(ii) Reversed Inorder; Tree traversal;

**I** Sort/ Re-arrange 2

[10]

**28.** (a) 2



1 mark for all three classes in appropriate boxes;

1 mark for arrows in correct directions;

(b) Insert a SetColour Procedure; **A** Function

into the Public section;

**R** make Colour Public 2

(c) Yacht = Class/ subclass (Boat) 1

(Public)

Procedure SetBoatDetails (Override) 1

Function GetMasts 1

Function GetEngine 1

Private

Masts : Integer 1

Engine : Boolean 1

End

**A** Procedure SetMasts and Procedure SetEngine/ Procedure

AddNewYacht/SetYachtDetails instead of Procedure SetBoatDetails

Masts and Engine must be private

P1 if extra functions/ variables are included

**R** any diagrams

**I** any parameters to methods

OR

Public class/subclass Yacht extends/inherits Boat 1

{

public void SetBoatDetails() 1

public int GetMasts() 1

public boolean/int GetEngine() 1

private int Masts 1

private boolean/int Engine 1

}

**A** public void SetMasts and public void SetEngine//

public void AddNewYacht/SetYachtDetails instead of public void

SetBoatDetails

[10]

**29.** (a) (i) member ID / user name; password/PIN;

**A** account name instead of memberID;

**A** answers to security questions; 2

(ii) Member (MemberID, CreditCardNo, Member(Full)Name, Address,  
DrivingLicenceNo, EmailAddress, Mobile(Tel)No/TelNo); + attributes  
from b(i)

**I** bars over attributes 1

(iii) ParkingArea (LocationCode, ParkingAreaName, PostCode);

**A** ParkingAreaID instead of LocationCode

**R** ParkingArea **R** Name as attributes 1

(iv) Car (CarRegNo, LocationCode);

**A** RegNo/CarReg instead of CarRegNo

Allow follow through on foreign key from (iii) 1

(v) Booking (BookingRefCode, CarRegNo, MemberID, StartDateTime,  
EndDateTime, LocationCode);;;

*1 mark for CarRegNo and MemberID;*

*1 mark for StartDateTime and EndDateTime;*

*1 mark for LocationCode;*

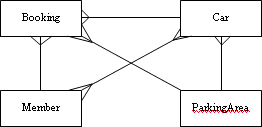
*1 mark for BookingRefCode as primary key;*

***A*** *2 separate attributes for DateTime*

**A** BookingRef/BookingID instead of BookingRefCode Max 3

Follow through on attribute names

(b)



*1 mark for each correct relationship,*

*If 4 or 5 relationships given, mark as follows:*

*All 4/4 or 5/5 correct: 3 marks*

*3/4 or /54 correct: 2 marks*

*2/4 or3/5 correct: 1 mark*

*All other cases: 0 marks*

**I** *relationship between Member and Parking Area* Max 3

(c) SELECT MemberID, (MemberFullName,) CarRegNo,

StartDateTime, (EndDateTime) FROM (Member,) 1

Booking

WHERE Member.MemberID = Booking.MemberID 1

AND EndDateTime BETWEEN 1/12/07 AND 31/12/07 1

ORDER BY MemberID (ASC/DESC) 1

**A** other attributes if present in candidate’s booking table 1

*Alternative Answer:*

SELECT \*; FROM Booking;

WHERE EndDateTime LIKE “\*/12/07”

**A** StartDateTime instead of EndDateTime 1

**P1** if attribute.table notaion used

**P1** for extra punctuation or tbl in front of table name 1

**I** punctuation around dates/times

**I** case of keywords etc 1

**A** other wildcard characters

*Alternative Answer:* 1

SELECT MemberID, MemberFullName, CarRegNo, 1

StartDateTime, EndDateTime

FROM Member INNER JOIN Booking

ON Member.MemberID = Booking.MemberID

WHERE EndDateTime >= 1/12/07 AND  
 EndDateTime <= 31/12/07 Max 4

ORDER BY MemberID

[15]

**30.** (a) *symmetric key encryption*: the same key/process/algorithm is used for  
encrypting and decrypting; **A** *sending/receiving instead of encrypting*  
*/decrypting  
public key encryption*: a public key and a private key // a pair of keys  
are used in combination; one to encrypt, the other to decrypt; 3

(b) (i) *when:* the symmetric key is sent (from B to A)

// when establishing the initial connection;

*how:* B must encrypt the symmetric key; with A’s public key;

so A can decrypt (the symmetric key) with A’s private key;

**A** A must encrypt the symmetric key; with B’s public key;

so B can decrypt (the symmetric key) with B’s private key; Max 3

(ii) anyone could intercept the message with the symmetric key  
(and then decrypt the personal data);

distributing the symmetric key securely is not possible  
(unless it is encrypted);

**R** unspecific answers such as ‘easily hacked’ 1

[7]

**31.** CREATE TABLE // CREATE INDEX // CREATE DOMAIN //  
CREATE TRIGGER // CREATE VIEW // GRANT …;  
**R** CREATE DATABASE 1

[1]

**32.** (a) next item to be added is at position/location/address (Tail + 1);

Position/location/address Tail is the last item in the queue ; max 1

**R.** ‘points to the end of the queue’

(b) Cat // item at position Head ; 1

(c)

|  |  |  |
| --- | --- | --- |
|  | 6 |  |
| Tail | 5 | ‘Shark’ |
|  | 4 | ‘Eel’ |
|  | 3 | ‘Snake’ |
| Head | 2 | ‘Frog’ |
|  | 1 | ‘Dog’ |
|  | 0 | ‘Cat’ |

Snake + Eel + Shark at positions 3,4,5 ; 1

Tail points to 5 ; 1

Head points to 2 ; 1

**I.** Dog and Cat crossed through

(d) Tail will eventually reach position 99 (**A**. 100) ;

Head will eventually reach 99 (**A**. 100);

Memory/queue will become full ;

Space is not re-useable ; max 2

[7]

**33.** (a) E X A M ; *Mark as follows:*

1 or 2 correct 1 ;

3 correct 2 ;

4 correct 3 ; 3

**R.** lower case

(b) (i) Universal Serial Bus; 1

(ii) Parallel ; 1

(iii) set of rules ;

sending signals between devices;

(computer) asks are you ready? ;

(printer) acknowledges yes I am ;

(computer) responds here comes the data ;

(printer) ‘thank you received’ ; max 2

(iv) acknowledge data received by the printer ;

error ;

line is busy / free / ready /‘status’ / ACK Request ;

timing / strobe;

interrupt; max 1

**R.** Ground

(v) operating system ;

word processing software / text editing software / any sensible

application ;

print spooler ;

printer driver ; max 2

**R.** ‘printing software’

[10]

**34.** (a) Interactive 1

(b) Real time 1

(c) Network 1

[3]

**35.** (a) by common / shared attributes;

/ by primary and foreign keys;

**A** actual example(s) from the tables

**A** fields instead of attributes 1

(b) BookID, DateOut;;

**I** MemberID

Other fields, penalise 2

(c) To speed up searching; 1

(d) Check digit; 1

[5]

**36.** (a) (i) Security: *1 mark for each of 2* ***examples*** *of different* ***types*** *of security  
failure* MAX 2

Unauthorised access to data;

Unauthorised / deliberate corruption / loss / alteration of

data/software;

Theft of / damage to hardware;

Accidental destruction of data by hardware failure /operator error;

Loss of data through natural hazards e.g. fire, flood, earthquake;

(ii) *Integrity: 1 mark for each of 2 reasons* MAX 2

Error on data entry;

Insufficient validation checks;

Virus corrupting file;

Program error corrupting a file or data;

Transmission errors;

(Duplicated) info. not fully updated;

(b) (i) Information about (living,) identifiable individuals

/ information that can identify (living) individuals; 1

(ii) *Up to two marks for practice relevant to a school / college  
for each type of security problems given in (a)(i)* MAX 4

*Unauthorised access to data*

Encrypt data;

only give key to certain people;

/Password protect;

change passwords regularly / password policy for ‘strong’ passwords;

/ Use *relevant*;

access rights;

/ Keep administration and academic networks;

separate;

/ Install firewall;

and regularly update it;

/ Described physical protection of system / data / workstations;;

*(marked in spirit of above)*

*Unauthorised / deliberate deletion / loss of data*

/Virus checker;

kept up to date;

/Regular backups;

kept securely;

*plus relevant items from unauthorised access if not already given*

*Accidental destruction by hardware failure / operator error*

/ Require confirmation;

of any editing / deletion;

/Regular backups; *(if not already given)*

kept securely;

*Natural hazards*

Regular backups; *(if not already given)*

kept securely;

/Uninterrupted power supply;

To allow systems to close down safely;

*Theft of / damage to hardware*

/ Described physical protection of system / data / workstations;;

*(marked in spirit of above)*

[9]

**37.** (a) *social;*

some people get so many junk e-mails/ spam take up

so much space;

that they have to change their e-mail address;

/ that legitimate e-mails get submerged by them;

/ service degrades;

//Some ISP’s spam filters;

reject legitimate e-mails;

// unkind / spiteful/ gossip type e-mails;

can be spread about a work colleague / ex ‘partner’; MAX 2

*economic*

wastes resources;

dealing with junk e-mail;

// corruption /damage to software and data;

from viruses carried by spam;

//many spam are fraudulent;

people pay for things that never arrive;

// ISPs have to pass on the cost of extra bandwidth;

to their customers; (Spam slows down Internet)

//people with dial-up connections

/ who receive e-mails on mobile phones;

have to pay to download the junk mail;

cost of;

spam filters; MAX 2

*ethical;*

/people / vulnerable adults upset by;

obscene / inappropriate e-mails;

phishing e-mails;

extracting personal /financial information; MAX 2

**A** *ethical - social, economic - social* cross over where valid, but points  
must be different.

(b) Have more than one e-mail address;

Use a spam black-list to refuse e-mails from known spamming sites;

Use a spam filter in the e-mail software / in house;

Careful choice of e-mail address; 1

[7]

**38.** (a) 40E 1

(b) 1038 1

(c) 64.875 1 mark for 64, 1mark for .875 **A** 7/8 2

(d) (i) 0.125//⅛;;;

If incorrect part marks as follows

mantissa = 0.5 or ½ 1

exponent = -2 1

times 2exponent 1

(ii) leftmost 2 digits/bits are different//

a significant bit is stored after the binary point//

bit after point different from bit before point;

**A** the first bit after the sign bit is a ‘1’;

**A** The second bit is a ‘1’;

**A** *an answer that clearly implies a ‘1’ follows the ‘0’* 1

(iii) 127;;//1111111;;//0.1111111; x 27/2111; 2

[10]

**39.** (a) Temp  Front;

Front  Temp.Next//Front  Temp^.Next;

Dispose (Temp); **A** Free(Temp)

Alternative

Temp  Front.Next// Temp  Front^.Next;

Dispose (Front); **A** Free(Temp)

Front  Temp; 3

(b) AddItem//Add; 1

(c) (i) Full/FullQueue; 1

(ii) No memory used for pointers;

**I** Faster

**R** Easier to program 1

(iii) Size is limited by array size;

memory wasted when not full; 2

[8]

**40.** (a)

|  |  |  |  |
| --- | --- | --- | --- |
| Number | Lower | Upper | Current |
| 12 | 1 | 9 |  |
|  |  | 5 | 5 |
|  | 3 |  | 3 |
|  | 4 | 4 | 4 |

|  |  |
| --- | --- |
| Value returned | 4 |

*1 mark for 1st row (12, 1, 9)*

*2 marks for second row (1 mark for each 5)*

*2 marks for 3rd row (3 and 3)*

*2 marks for 4th row (1 mark for Lower = 4, 1mark for upper = 4)*

*1 mark for correct return value* 8

(b) Find the position of 12/ a number in the array// search for 12/ a number in  
the array; 1

[9]

**41.** (a) mouse click// mouse movement// keyboard operation// any interrupt; 1

(b) event-driven programs service an event and wait for another;  
non event-driven programs run to completion/ are sequential; 2

(c) contains its own data/fields/variables/properties;

contains its own

operations/methods/functions/procedures/behaviours/code;

responds to messages;

**A** Based on a Class definition max 2

(d) frame/form/window/button/check box/radio button/menu/text box;

**A** any sensible widget

**R** Plurals 1

[6]

**42.** *(a)* *& (b) must be different* *(c) & (d) must be different*

(a) **barcode scanner**: scan ID card to register when entering/leaving the  
room; 1

(b) **fingerprint scanner**: to login at computer, can not be abused like user

name and password;

to register when entering/leaving the room;

to ensure the identity of the student (can not use someone else’s)

entering the room/logging on;

**I** fingerprint to check ID card is genuine max 1

(c) **digital still camera**: to produce photos for ID card;

to produce photos for database to help identify students;

to take photos of student entering room; max 1

(d) **digital video camera**: to record/monitor activity in room;

to help identify students if there has been misuse/damage; max 1

(e) **programmable doorlock/turnstile**: admit only authorised persons;

admit only persons with valid ID card; automatic locking at certain times;

if used when entering and leaving, can record time in room; max 1

(f) **RFID tag reader**: if students are issued with a RFID tag instead, the

reader will detect their presence without the student having to swipe their

ID card through a reader;

faster process to log student’s ID as they enter/leave the room if student

is given an RFID tag;

tracking location of students with RFID tags;

tag equipment to stop it being taken out of the room;

scan RFID **BoD**; swipe RFID is **T.O.**

**R** references to smart card **R** tagging unauthorised people max 1

[6]

**43.** (a) Copyright, Designs and Patents Act (1998); *if other laws included* **T.O.** 1

(b) *boxes for correct entities: SoftwareLicence SoftwareInstallation one mark*

*correct degree of relationship: 1 to many one mark*

*suitable name for relationship: one mark* 3



(c) *any sensible field length accepted except for SoftwareID, ComputerID,  
StaffID*

(i) SoftwareID VARCHAR(10) PRIMARY KEY (NOT NULL)

// SoftwareID VARCHAR(10) PRIMARY KEY(SoftwareID);

|  |  |
| --- | --- |
| SoftwareName VARCHAR(30)  Supplier VARCHAR(20)  DatePurchased DATE  Version VARCHAR(10) |  |
| ExpiryDate/DateValidTo DATE | 1 mark for any 3 attributes correct  P1 if extra symbols used  Ignore spaces and case in attribute names |
| NoOfLicences INT |  |

3

(ii)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| SoftwareID VARCHAR(10) | A char/string/text/alphanumeric  Instead of VARCHAR  A Date/Time instead of Date  A Integer instead of INT  BOD any attributes which are clearly more than 1 word | | | | | |
| ComputerID VARCHAR(6) | | | | |
| DateInstalled DATE | | | 1 mark for any 2 attributes correct | | |
| StaffID VARCHAR(3) | |  | | | |
| PRIMARY KEY (SoftwareID, ComputerID);  FOREIGN KEY (SoftwareID) | | | | If not DDL give 1 mark  if composite key  identified | |
| REFERENCES Software Licence(SoftwareID); | | | | | |

4

**I** NOT NULL

(d)

|  |  |
| --- | --- |
| SELECT ComputerID, SoftwareName, Version ; | Extra attributes: T.O. |

FROM SoftwareLicence, SoftwareInstallation ;

WHERE SoftwareLicence.SoftwareID=SoftwareInstallation.SoftwareID ;

ORDER BY ComputerID; **A** ASC or DESC 4

|  |  |  |
| --- | --- | --- |
| Accept (instead of FROM WHERE): FROM SoftwareLicence INNER JOIN SoftwareInstallation ON SoftwareLicence.SoftwareID = SoftwareInstallation.SoftwareID |  |  |
|  |  | P1 for other spurious punctuation inc semicolons |

**A** LEFT JOIN

|  |
| --- |
| Table names prefixed with tbl, P1 |
| If table name and attribute transposed, P1 |

[15]

**44.** (a) If you send the key with the message, anyone can decrypt the message 1

key would need to be sent by means other than email, otherwise anyone

could intercept the key and use it do decrypt the message;

(b) (i) Jill’s public key; 1

(ii) Jill’s private key; 1

(c) (i) the message data is hashed into a message digest;

the message digest is encrypted; with the sender’s private key; 3

(ii) Jill’s software decrypts the signature;

using Jack’s public key; contained in digital certificate sent with

message;

to verify Jack’s public key;

decrypt digital certificate using Certificate Authority’s (trusted third

party’s) public key;

Jill’s software then hashes the document data into a message

digest;

If recalculated message digest is the same as

the original message digest (decrypted signature);

then Jill knows that the signed data has not been changed; 4

**I** decryption of message

[10]

**45.** (a) (i) computers/devices/nodes/PCs connected/linked/communicate together ;

**R.** machine

**A.** using a LAN protocol e.g. Ethernet

over a small geographical area / e.g. a room/a building /a site ; 2

(ii) bus ; **R.** line 1

(iii) serial ; 1

(iv) ring // star ; 1

(v) printer; (bar code) scanner; multifunction machine ; modem ;  
message boards ; server

providing audio/video or any additional server; console dedicated  
to audio/video ;

projector ; FAX machine ; external hard drive ; card reader ;

**A**. bridge / hub, / switch / router / gateway / firewall ; MAX 2

(b) (i) bargainbooks-r-us.co.uk ; 1

**R.** answer with anything added to this

(ii) The file (name); the page requested; home page; MAX 1

(iii) the web server cannot find the page requested //

(examples) the page has been deleted / moved to different folder /  
does not exist ;

the page is in the process of being updated / page is currently off-line;

**R.** anything which implies there is no connection

**R.** timed out 2

(c) (i) computers (and networks) connected/linked/communicating ;

**A**. using a WAN protocol e.g. TCP/IP

over a large/wide geographical area / e.g. city/county/country/ globally /  
e.g. The

Internet ;

**R.** WWW 1

(ii) e-mail communication with the outside world (A or B) ;

email/easier communication between libraries // the library and a  
borrower (A or B) ;

enquiries about books available at other libraries (A or B) ;

electronic transfer of documents/information between libraries (A only) ;

backup of data/network administration for all libraries is more

manageable/done centrally (A only) ;

**A**. Accept benefits which imply access to the World Wide Web /  
Internet (A or B) ; MAX 2

[14]

**46.** (a) (i) String / Text / Char ;

**R.** alpha / alpha-numeric / character 1

(ii) Integer / Date (and Time) ; **A.** String 1

(iii) Boolean ; **R.** Yes/No 1

(b) (i) Book ; 1

(ii) False / F / No // f/t from the (a) (iii) answer e.g. stated as  
integer - value 0/1 1

(iii) True / T / Yes // f/t from the (a) (iii) answer e.g. stated as  
integer - value 1/0

(MAX 1 for (ii) and (iii) if no indication of meaning when integer used) 1

(c) (i) T76542 ; 1 ; 2

(ii) T ;

**I.** the quote marks (i) and (ii) 1

(iii)

|  |  |  |
| --- | --- | --- |
| NextAvailableCode | Book | LocationLetter |
| 1 | 1 | ‘T’ |
| 2 | 2 | ‘T’ |
| 3 | 3 | (gap not required) |
| 4 | 4 | ‘M’ |
| (in sequence – possible repeat of 3 and/or 4 | 5 | Penalty -1 if the first ‘M’ is followed by either ‘T’ or ‘X’ |
|  | 6 |  |

**Figure 2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Location |  |  | NewCode |
| [1] | ‘Torrington’ |  | [1] | 1 |
| [2] | ‘Torrington’ |  | [2] | 2 |
| [3] |  |  | [3] |  |
| [4] | ‘Morristown’ |  | [4] | 3 |
| [5] |  |  | [5] |  |

**Figure 3** **Figure 4**

6

[15]

**47.** (a) Last (item) in, is the first (item) out / first (item) in is the last (item) out ; 1

**R.** LIFO / FILO

(b) (i)

|  |  |
| --- | --- |
| 600 | ‘A’ |
| 601 | ‘V’ |
| 602 | ‘E’ |
| 603 | ‘R’ |
| 604 | ‘Y’ ; |
| 605 |  |

All items in the correct locations 1

(ii)

|  |  |
| --- | --- |
| 599 |  |
| 600 | ‘A’ |
| 601 | ‘V’ |
| 602 | ‘E’ ; |
| 603 |  |
| 604 |  |
| 605 |  |

Correct three items // ft from an incorrect (i) including 605  
as the first location used ; 1

**A**. ‘R’ and ‘Y’ entries indicated in some way as ‘deleted’ 1

(iii)

|  |  |
| --- | --- |
| 600 | ‘A’ |
| 601 | ‘V’ |
| 602 | ‘E’ |
| 603 | ‘S’ |
| 604 | ‘P’ ; |
| 605 |  |

Correct list of five items // ft from an incorrect (i) + a correct ft  
(ii) including 605 as the first location used ;

(c) (i) Queue ; **A.** First In – First Out FIFO / LILO 1

(ii) Items are removed/popped from the stack (one at a time)  
(and items are then added to the queue); 1

(iii) Items leave the queue on a ‘first in-first out’ basis ;  
**A.** from the front of the queue 1

(iv) ‘Y’, ‘R’, ‘E’, ‘V’, ‘A’ on the queue ;

‘Y’, ‘R’, ‘E’, ‘V’, ‘A’ on the final stack ;

**A.** using 701 for the first queue location 2

[9]

**48.** (a) (i) *Unauthorised access*

password protect sensitive files; 1

//have username & passwords to log on;

/ have username & password / use biometrics to restrict access;

AND change passwords on a regular basis; 1

/ choose passwords that are difficult to guess;

/ do not write passwords down;

/ shut down after (e.g.) 3 attempts at guessing the password;

**A** and set attributes/permissions/access rights;

//Set attributes/permissions/access rights; 1

AND to restrict access to specific users or groups of user; 1

//Use biometrics /lock doors to rooms where terminals are 1

/employees log off / lock machines when they leave them;

AND to restrict access to sensitive files to certain terminals; 1

// encrypt (sensitive) files; 1

AND only authorised users have (decryption) code/key; 1

(ii) use software that can monitor /log user activity **A** record, **R** store  
/monitor file changes; 1

(b) (i) *data protection*

Firewall; 1

**A** ‘strong’ passwords

**A** Encrypt data ;

(ii) Use up to date virus checking software; 1

A Regular backups (*if not given in iii*)

(iii) Regular / automated backups; 1

/Uninterruptible power supply; (so that system can be shut down safely)

(c) *restore*

a good recovery / restore procedure; **A** description of this 1

/backup media must be available immediately;

/ availability of alternative hardware;

**A** Make regular backups *if not given in (iii)*

**A** have a contract with an outside recovery service;

[13]

**49.** (a) (i) *operating systems*

Allocate hardware resources;

between applications / processes requiring them;

to ensure efficient use / no hold-ups / maximise throughput;

to deal with hardware malfunctions / maintain hardware functions;

*1 mark per point to max* 2

(ii) Processor / CPU;

(Main) Memory / IAS ;

Backing Store / Secondary Store /File space; **A** *examples, but only one*

Input devices; *of each type*

Output devices;

Peripherals; *(if I/O devices NOT given)*

File space;

**R** programs, data, files (as *not hardware*)

*1 mark per resource to max* 3

(b) hides the complexity of the hardware;  
from the user;

// provides an interface; **A** GUI

between the user and the computer; max 2

(c) (i) *Batch processing*

Payroll;

BACS cheque processing;

Producing Utility bills;

*1 reasonable example* 1

(ii) Data entered off line;

Processing delayed until all data entered

/ data collected over a fixed period of time before processing;

Batch integrity checks employed;

There is an acceptable time delay between data input and final output

Processing frequently carried out at night when system is quiet;

Once started, there is no interaction between user and computer;

Data is processed sequentially;

Process controlled by instructions written in JCL;

*1 mark per point to max* 2

(d) *Batch operating system*

Supports processes which are sequential in nature;

Requires all data and commands to be supplied along with job;

Once started, there is no interaction between user and computer;

Processes (jobs) are queued;

Operator can intervene;

Process controlled by instructions written in JCL;

OS schedules tasks;

*1 mark per point to max* 2

[12]

**50.** (a) 35,37; 1

(b) 53,55; 1

(c) 00111001;; *1 mark for sign, 1 mark for value*

**A** 11000111 *1 mark* 2

(d) 0.1110010 ; 00000110; 2

(e) To allow a wider range of values to be stored;

To minimise rounding errors//

greater accuracy/precision using a given number of bits; 2

[8]

**51.** (i) To provide a standard interface to the O.S.;  
**A** Communicates with the O.S.;  
To control the hardware/device;  
To sense the status of the device;  
To read/write registers in the device controller; max 2

(ii) To allow a range of hardware;  
That was not available when the O.S. was written;  
To allow compatibility between different manufacturers;  
To reduce the size of the O.S.; max 2

(iii) A language that allows registers to be read/written//  
Assembly Code;  
**A** Machine Code  
**A** ‘C’/BCPL/CPL  
**A** Low level language 1

(iv) Requires direct access to the registers/memory (in the I/O (device)  
controller);  
**R** access hardware  
Needs high speed execution/processing;  
Uses minimum memory// Minimises program code;  
Needs to allow low level commands found in the instruction set;  
**A** Assembly Code/‘C’/BCPL/CPL easier to write than machine  
code if consistent with (iii) max 2

[7]

**52.** (a) An object that contains other objects;

**A** A class containing other classes; 1

(b) (i)



*1 mark for class entries*

*1 mark for connections* **A** circles or diamonds, filled or not 2

(ii)

max 8

[11]

**53.** (a) A procedure that is defined in terms of itself;

**A** A procedure that calls itself

**R** re-entrant 1

(b) Store return addresses;

Store parameters;

Store local variables/ return values; max 1

(c)

|  |  |  |
| --- | --- | --- |
| Number | Entry | Output |
| 11 | 1 |  |
| 11 | 2; |  |
| 11 | 3; |  |
| 11 | 4; | 4; |
|  |  |  |

4

(d) A linear search//  
To find/output the position/index of Number in Items; 1

(e) Number is not an entry in Items// Stack overflows; 1

(f) Test for reaching the end of Items; 1

(g) Binary Search;  
An iterative solution; max 1

[10]

**54.** (a) (i) *dialup*: A temporary, as opposed to dedicated, connection over  
a telephone line;

slow rates of data transfer; **A** slow;

baseband // can only be used by one device at a time;

converting signal from digital to analog (and vice versa);

(ii) *cable modem*: A cable modem can transfer data at much higher rates  
compared with dial-up

modems; A faster than dial-up;

**R** references to DA conversion

connection is via cable television cables/fibreoptic cable; **R** wire

dedicated connection//always on;

Speed depends on concurrent sharing;

broadband // line can be used by several devices at the same time;

(iii) *ADSL*: allows more data to be sent over a telephone line per unit time

// supports higher data rates when receiving data than when sending data

// greater downstream rate than upstream rate; A faster than dial-up;

speed/availability is dependent on distance from telephone exchange;

broadband // line can be used by several devices at the same time;

dedicated connection // always on // computer connects almost  
instantaneously; 6

**I** cost/payment

(b) (i) router/gateway connects to modem/Internet/telephone line;

each computer links to the router;

any computer can link to Internet without access to another computer;

Laptop can access the desktop computer’s files (via the router);

OR

desktop computer(‘s modem) connects to Internet;

laptop computers link to desktop;

desktop must be switched on for laptops to be able to access  
the Internet;

laptop can access the desktop computer’s files; max 3

(ii) desktop acts as server // buy a dedicated server (to store the shared files);

server/desktop’s modem connects to Internet;

laptops act as clients (to desktop/server);

laptops request files from [desktop] server; max 3

(c) (i) 192.168; **A** 192.168.0.0; R 192.168.x.y 1

(ii) *range for desktop:* 192.168.0.2; to 192.168.255.254;

192.168.0.1; to 192.168.255.254; A 192.168.255.255  
as top end of range 2

(iii) *subnet mask:* 255.255.0.0 // 255.255.224.0 // 255.255.192.0 //  
255.255.128.0; 1

(d) (i) *virus attack:* run/use/install virus checking/ anti-virus software

// regularly update the virus checking software (database); 1

(ii) *unauthorised access:* use/install firewall; using non-routeable  
addresses in LAN;

make folders/directories/files non-shareable/invisible/  
password-protected // encrypt data;

**P1** for buy password-protect computer/data NE max 1

(e) (i) *cable required:* Ethernet cable // 10BASE-T // 100Base-T // 1000Base-T

// twisted pair // Cat3 // Cat5 // mains cable // internal tel cable  
// fibre optics; 1

(ii) *hardware required:* wireless access point/hub/router;

wireless network card/adapter; 2

(iii) *advantage:* do not need cables trailing through house

// can work anywhere within range of access point

// other members of family/visitors can easily join network; 1

(iv) *disadvantage:* less secure // neighbours may try to use bandwidth;

prone to interference;

signal may be poor (depending on house construction);

likely to be slower than any cabled connection;

Health & Safety issues; max 1

[23]

**55.** (a) (i) Recipe table; **A** Figure 2; 1

(ii) *Why:* contains multiple values in Ingredients field/attribute/column

// data in Ingredients column not atomic // repeating groups; 1

(b) (i) *fully normalised:*

every attribute is dependent on the key, the whole key and nothing  
but the key;;

OR (tables contain no repeating groups of attributes,) no partial  
dependencies;

no non-key dependencies; A rely on instead of depend on

OR if (and only if) every determinant in the relation is  
a candidate key;; 2

(ii) *Why:* to aid consistency of data // to avoid potential data  
inconsistency problems

// to eliminate data inconsistency // to minimise data duplication

// to eliminate data redundancy; A reduce instead of eliminate

R saving space 1

(c) (i) Recipe (RecipeID, Dish, PrepTime, CookTime, NoOfServings,  
CookInstructions); 1

(ii) FoodItem (FoodItemID, FoodItemName, PackSize, Price); 1

(iii) RecipeIngredient(FoodItemID, RecipeID, Quantity) 4

*1 mark for each correct field, 1 mark for correct primary key*

*(take off 1 mark for every extra field included)*

(d) SELECT FoodItemName, Quantity, PackSize, Price 1

FROM FoodItem, RecipeIngredient, Recipe 1

WHERE (Recipe.RecipeId = RecipeIngredient.RecipeId) 1

AND (RecipeIngredient.FoodItemId = FoodItem.FoodItemId) 1

AND (Recipe.Dish = “Feta Salad”) 1

ORDER BY FoodItemName ASC 1 max 5

*field names* **F/T** **P1** *for fieldname.tablename* **P1** tbl prefix

**A** ORDER BY FoodItemName

**A** Dish instead of Recipe.Dish

**A** ‘feta salad’ instead of ‘Feta Salad’ A #feta salad# instead of ‘Feta Salad’

[17]

**56.** (a) *Network card*

• allow the PC to communicate/send and receive/transfer data with   
other devices on the network / uses a standard protocol;

• card holds the unique network address for that device / decides  
whether data sent along the cable has a destination of ‘this’ computer;

• card converts parallel data from the PC to a serial stream of data  
(for sending on the network) / or vice versa;

**R.** ‘connnect’ MAX 2

(b) *Benefits of having a network*

• provides for more effective data transfer / easier to transfer data;

• provides for the centralised storage / management of data files /   
folders / documents / programs / e.g. improved management of   
documents/contract changes;

• allows specialist applications to be used e.g. internal e-mail,   
diary scheduling applications;

• more flexible work practices;

• Internet access from any terminal;

• central control over the security of data / backup of data / usage;

• centralised management of software patches/upgrades;

• create an Intranet site;

• sharing files;

• sharing of peripherals /e.g. colour printer; MAX 3

**R.** Sharing programs // Better communication between users

[5]

**57.** (a) *Serial transmission*Bits are sent along a single wire/line // bits are sent one after the   
other / ‘bit by bit’; 1

(b) (i) 1; 1

(ii) (5 \* 768 \* 1024 / 1024) // 3840 Kbytes;  
**F/T** from (i); 1

(c) *Advantage:*The sound quality is higher/better; 1

*Disadvantage:*The files will be larger / files take up more disc space; 1  
**R.** anything which suggests ‘data transfer’

[5]

**58.** (a) (i) • poorly structured code;

• uses GoTo statements;

• the flow of control jumps out of a loop;

• nothing reported to the user when no matching name found;

• abbreviated variable for ‘position’ variable;

• ReadLn is better than Read;

• Program only iterates once / considers only the first array element;

• (if duplicates) only the first matching surname is found;

• (loop terminates at 20) does not allow for additional array   
/name entries;

**A.** poor layout - excessive indentation used; MAX 2  
**I.** variable declaration // reference to the syntax

(ii) *All statements must have*correct identifier name  
correct data type (String / Text // Integer / Byte / Word / Int /   
Shortint / Short as appropriate)

*In addition, either array must have*brackets to indicate an ‘array’  
19/20 to indicate a range; MAX 2

(b) *Intialisation of counter or Boolean variable* P := 1 / P := 0 / For P := 1 to 20 // IsFound := False;

*Looping* LOOP UNTIL // DO WHILE // WHILE DO // REPEAT UNTIL   
 and used at the beginning/end of a code block as appropriate;

*Some loop condition is met* (P = 20/21) OR IsFound = TRUE / P = 20/21 // IsFound = TRUE / IsFound;

*IF with use of the array* IF NoOfClaims [P];

*Selection condition* >4 / >=5;

*Loop counter incremented* P = P+1

*Final output* Correct logic followed with OUTPUT ‘Yes’  
 **A.** multiple times

*Final output* Correct logic followed with OUTPUT ‘No’  
 **R.** Multiple times

**R.** ‘Prose’ scores 0 5

[9]

**59.** *Any 2 reasons @ 1 mark each*  
to prevent unauthorised users understanding any intercepted data;  
to prevent the message being altered; to identify authentic users; 2

[2]

**60.** (a) So the resulting password will not be easy to guess 1  
/Harder to hack;   
**R** general security - TV

(b) 1 Convert each character to a numeric equivalent; **A** password

2 Perform some arithmetic on the number string;   
**A.** concat, algorithm, example of arithmetic,   
**R.** Process number, Translate

3 Reduce/Map arithmetic result onto two-byte integer range  
//example of mapping;  
*NB must be two bytes***R.** To give a byte no. 3

[4]

**61.** (a) 974; 1

(b) 151.25;;  
1 mark for integer part, 1 mark for fractional part 2

(c) –104.75;;  
If answer not correct award 1 mark for attempt at complementing   
the binary pattern 2

(d) (i) –13.125;;;  
Allow method marks  
 1 mark for 2 4 seen or correct 4 bit shift  
 1 mark for integer value correct including sign  
 1 mark for fractional part 3

(ii) To maximise precision in a given number of bits //   
To minimise rounding errors //   
To have just one representation of the number //   
To simplify arithmetic operations;   
**A** to maximise accuracy in a given number of bits 1

[9]

**62.** (a) (i) Empty entries waste space // Maximum/fixed/static size  
**A** stack may overflow 1

(ii) Space used by pointers // more complex to program; 1

(b) (i) The size of the stack /amount of data is known/limited/predictable   
Memory saved since no pointers (if not given in a (ii))  
**R** easier to program 1

(ii) The size of the stack is unknown//  
The stack is volatile/ number of items fluctuates widely; 1

[4]

**63.** (a) a procedure/routine that calls itself/ is defined in terms of itself;  
**A** Function instead of procedure   
**R** re-entrant **R** program **R** iteration 1

(b) (i)



6

(ii) In order; (tree) traversal 2

[9]

**64.** (a)



1 mark for all three classes in appropriate single enclosures   
1 mark for correct independent arrows in correct diections 2

(b) (Insert) a SetColour Procedure;   
**A** Function into the Public section;   
**R** make Colour Public 2

(c) Van = Class/ subclass (Vehicle)ie. Clearly identify Van as a (sub) class   
of vehicle 1

(Public)  
Procedure SetVehicleDetails (Override) condone if not included 1  
Function GetCapacity 1  
Function GetTailLift 1  
(penalise extra functions/procedures once)   
Private

Capacity : Integer/real/fixed/float 1  
 TailLift: Boolean 1  
(penalise once if not private and once if extra variables listed)

End

**A** Procedure SetCapacity and Procedure SetTailLift/  
Procedure AddNewVan instead of Procedure SetVehicleDetails

OR

Public class/subclass Van extends/inherits Vehicle 1  
{  
public void SetVehicleDetails 1  
public int GetCapacity 1  
public boolean/int GetTailLift 1  
private int Capacity 1  
private boolean/int TailLift 1

**A** public void SetCapacity and public void SetTailLift//  
public void AddNewVan instead of public void SetVehicleDetails   
**R** any diagrams   
**I** any parameters to methods 6

[10]

**65.** (a) CandidateNumber; 1

(b) table contains repeating groups; **R** repeated data/fields/attributes

|  |
| --- |
| There is redundant data **T.O.** |

ModuleCode, ExamSession, ModuleMark, Level, TotalMark, Grade  
contain multiple values; *mention at least one attribute by name  
(forename/ surname T.O.)* max 1

(c) *1 mark for correct primary key, 1 mark for correct other attributes*,  
***I*** *spaces/underscores in attribute names*

|  |
| --- |
| *Extra attributes = T.O.* |

(i) Pupil (PupilForenames, Pupil Surname, CandidateNumber);  
**A** (Forename,Surname,CandidateNo) 2

(ii) ModuleResult (CandidateNumber, ModuleCode, ExamSession, 2  
ModuleMark)

(iii) PupilGrade (CandidateNumber, Level, TotalMark, Grade) 2

(d) 2



(e) *Must use same attributes as in (c) above (mark as F. T.)* ***I*** *case*

|  |
| --- |
| If pupilForename.pupil penalise once |

SELECT PupilForenames,Pupil Surname, Grade *I pupil*. / *pupilgrade*. 1

FROM Pupil, PupilGrade 1

WHERE Pupil.CandidateNumber = PupilGrade.CandidateNumber

AND Level=“ A” *accept* Level=‘A’ *or* Level=A 1

ORDER BY TotalMark DESC; **A** Descending 1

OR SELECT PupilForenames,PupilSurname, Grade 1

FROM Pupil INNER JOIN PupilGrade ON Pupil.CandidateNumber =  
PupilGrade. CandidateNumber 2

WHERE Level = “A” *accept* Level = ‘A’ *or* Level=A 1

ORDER BY TotalMark DESC; **R** = Desc 1 5

[15]

**66.** (a) in a peer-to-peer network there are no dedicated servers;  
in a peer-to-peer network all computers are equal / have equal status;  
each computer functions as both a client and a server;  
user at each computer acts both as user and administrator;  
user at each computer controls what is shared with other computers;  
a user logged in at one peer computer is able to use resources on any   
other peer computer;  
**R** each computer directly connected to each other, so can send to  
each other without a server  
**R** all computers have same rights max 1

(b)



*1 mark for switch with 4 computers/PCs connected;*  2 *1 mark for printer connected to computer;*

(c) (i) Computer C is in a different subnet // network ID is different; 1  
**A** correct IP address

**A** there are two subnets **R** not on the same LAN

(ii) 192.168.5; **A** 192.168.5.0; 1

(iii) 0-255; more correctly: 1-254;  
**or any in the range** 192.168.5.1 - 192.168.5.254

|  |
| --- |
| **R** a specific  IP address |

(since 0 means all addresses on subnet, and 255 is reserved as  
broadcast address) 1

(d) (i) a router is a device that receives datagrams/packets from one  
computer and uses the IP addresses that they contain to pass on   
these packets, correctly formatted, to another computer;   
a router is a device that uses IP addresses to route packets/datagrams;

router keeps LAN traffic segregated from connection to ISP; 1

(ii) IP address: 222.125.105.15

Reason: router needs to have a presence on Internet so that it can be  
reached from anywhere;

Public address must be unique over whole Internet // must be visible   
on Internet // provides identity on Internet;  
**A** because 192.168.5.1 is a private/non-routable address; 2

(iii) 192.168.5.1 1

[10]

**67.** (a) converting/transforming from plain text into ciphertext/secret code;  
**A** scrambled; **A** transposition / conversion / coding

the sender processes the message prior to transmission so that if it is   
accidentally or deliberately intercepted while it is being transferred it   
will be incomprehensible to the intercepting party;

Data coded so that unauthorised users can’t read or access the data; max 1

(b) (i) B’s public key; 1

(ii) B’s private key; 1

(c) (i) a hashing function is applied to the text of the message;  
the result/message digest is encrypted;  
using B’s private key;

**A** the data generated is added to the end of the message;  
**A** message/date stamp is used to produce digital signature; max 3

(ii) A uses Certificate Authority’s public key;  
to verify B’s public key;  
digital signature is decrypted;  
using B’s public key;  
the hashing function is applied to the text of the message;  
the result of the hashing function is compared with the digital   
signature;  
if they are the same the message is authentic; max 4

[10]

**68.** (a) salesperson 7;  
April /month 4;  
The number of storecards ‘taken out’; max 2

(b) StoreCards + sensible subscripts [1..10, 1..6] / (1 to 10, 1 to 6) / [0..10, 0..6]   
/ (0 to 10, 0 to 6) / (10,6) / [10] 6];  
StoreCards + Integer / Byte; 2

(c) StoreCards (8, 1);  
= 13 / := 13 / ← 13;  
Must be an *assignment statement* 2

(d) key in / Input the employee number;  
the program calculates the total number of store cards for a single person  
// print/outputs/displays the total for a single person;  
over six months; max 2

(e) (i) single / real / float;  
**R.** Floating point / Double 1

(ii) Boolean /Yes-No / True-False; **R.** Y/N / T/F 1

(iii) integer/ byte; 1

[11]

**69.** (a) allows for the sharing of peripherals/hardware; **R**. ‘Resources’  
programmers can access their work from any terminal;  
better communications / internal e-mail/instant messaging;  
easier/quicker/instant sharing of a program library/ sharing   
program code/ data files;  
central storage of documents e.g. program specifications;  
changes to important documents are held centrally / document management;  
setting up of an Intranet (for document management);  
easier for the backup of data;  
**R.** anything about program updates max 2

(b) (i) Easier/quicker installation/maintenance of the application software   
/ easier backup (only if not in(a)); 1  
**R.** Saves space on the PCs / ‘Security’ / cheaper (licensing)

(ii) if server goes down software (may) still be available;  
software will load/accessed faster from secondary store;  
software can be personalised for individual user;  
helps to avoid degradation in network performance; 1 **R** anything about the software runs faster

(c) (i) *protocol*set of rules (about the way devices communicate); 1  
**A** standards **R.** Instructions

(ii) *handshaking* …  
sending signals between devices + implication of 2-way;  
confirmation of ready for sending / receiving data;  
acknowledge that a transfer is completed; max 2

(d) smk-solutions.co.uk; 1  
**R.** www.smk-solutions.co.uk

[8]

**70.** *Characteristics of real time OS*

(a) *1 mark per characteristic to max:*  
to support operations which are non-sequential in nature; 2  
to deal with a number of events which happen in parallel;  
to deal with events at unpredictable moments in time/ *concept of* monitoring & reacting;

(b) *examples of real time systems (must be appropriate to real time processing)*

1 *mark per reasonable example of each to max:* 2e.g.:  
Extremely fast, **to:** control a nuclear reactor;  
 control a fly-by-wire aeroplane;  
 control a life support machine / car navigation system (GPS) / Engine   
 ECU / autopilot

Not so fast, **to**: manage climate control in a(Kew Gardens) plant house /   
greenhouse;  
manage Traffic lights /   
**R** pseudo real-time systems such as on-line transaction processing, ATMs.

[4]

**71.** *e-mails*

encrypt the message: 1  
//keep password(s) for accessing account(s) / system private;  
//log off from the computer at the end of the session;

[1]

**72.** (a) *Resource management*  
memory management;  
resource allocation and scheduling;  
file / magnetic disc / secondary store /backing store management;  
peripheral device management;   
interrupt handling;  
 ***A*** *valid specific tasks* *one mark per task to max:* 3

(b) *Provision of a virtual machine*  
hide the complexities of the machine from the user; 1  
// provide an interface between the user and the computer;

(c) Network OS *in addition to a stand-alone computer*  
control access by multiple users;   
share network resources such as (shared files / applications / databases)   
manage more than one user using an application concurrently;  
manage printing from more than one computer on the network;  
manage security with more than one work station;  
redirect request to a remote resource (e.g. shared disk);  
establish / maintain communication between the work station and the   
server / between two workstations; **R** connections  
*1 mark per point to max* 3

[7]

**73.** (a) *Disadvantages of system*  
*Causes* Repetitive data entry;  
 Data items stored on more than one file / duplicated;  
 files cannot be shared;  
 No centralised, authoritative store of data;  
*Effects:* wastes time;  
 increases risk of errors;  
 wastes storage space;  
 can cause data inconsistency;  
 won’t know which data is correct if two different versions;  
 *1 mark per cause and 1 per resultant effect to max*  4  
 *Can give more than 1 effect per cause*

(b) *sharing files*  
Data files are structured differently / have different fields;  
for different applications;  
so may not be compatible;  
//Different files may have e.g. names and addresses;  
in different formats / field lengths; 2

(c) *Definitions*

(i) attribute – a property or characteristic of an entity; 1

(ii) primary key – an attribute that will identify a particular instance   
of an entity  
Aa field which identifies a record 1

(iii) foreign key – an attribute in one table that is (linked) to a primary   
key attribute in anther table;  
A a field in one table which is a primary key field in a (linked) table 1

(d) (i) CustomerID; 1

(ii) OrderNumber & OrderLineNumber 1  
**A**OrderNumber & PartNumber

(iii) PartNumber, OrderNumber 1

(iv)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Field* | *Surname* | *FirstName* | *DateOfOrder* | Description | Quantity |
| *Table* | Customer | Customer | Order | Stock | OrderLine |
| *Show* |  |  |  |  |  |
| *Criteria* | [(Enter) Surname] | [(Enter) First Name] | [(Enter) Date of Order] |  |  |
| *//Criteria* | Smith | Jeremiah | =23/04/06 |  |  |

*Mark as follows: nb Either Enter or [ ]*2nd column Customer + [Enter Surname] / Smith 13rd Column Customer + [Enter First Name] /Jeremiah 14th Column Order + [Enter Date of Order] or =23/04/06 1 //Order + = #23/04/06#  
 **A**date in other similar formats, Order + 23/04/06  
5th Column Description + Stock 1 // PartNumber + OrderLine   
6th Column Quantity + OrderLine 1  
‘Show’ (tick, ‘Yes’, ‘true’) for Description (PartNumber) + Quantity 1 **A**Show in all columns  
**I** anything else in ‘show’ cells  
*(5th & 6th columns can be interchanged)*

[18]

**74.** (a) Server provides a resource/the Internet/a database/file/application/  
CD ROM/printer;  
Within a network;  
Client computer requests the service;   
and waits for the response;  
**I** any reference to the user Max 3 3

(b) (i) Software request causes an event;  
**A** external change causes an event  
The event causes a program/ procedure/ function to execute;  
**I** References to user 2

(ii) Mouse Click// mouse movement// key pressed// record read/  
written//any external/internal device requires attention; 1

[6]

**75.** (a) Part of the hard disk is allocated to be used as virtual memory;  
Contents are copied into main memory as required;  
Partially loaded programs may be executed;  
Virtual address space can exceed physical address space; Max 3 3

(b) Main Memory is divided into fixed sized pages/frames;  
Program subdivided into same sized pages;  
Pages are swapped/loaded as needed;  
Page table keeps track of pages;  
**A** Paging is a method of implementing virtual memory;  
Do not give same point in (a) and (b) Max 2 2

(c) The memory that is unallocated/ available/free;  
Is used by the operating system to allocate memory to   
processes/running programs;  
Is used when a process/running program requires memory   
dynamically; Max 2 2

[7]

**76.** (a) (i) 271; 1

(ii) The required item might be the 271st one/last one/ not be present//  
Every item accessed; 1

(b) (i) 9; 1

(ii) Each comparison halves the number of items to be accessed//  
271 lies between 28 and 29; 1

(c)



1 mark for Count1  
1 mark for Count2   
1 mark for Temp 5

(ii) (bubble) sort the items into ascending order; 1

(iii) Reduce the number of tests each pass// stop when no swaps   
occur during a pass//Add a flag NoSwaps to indicate when   
no swaps occur// change loop control to Repeat until no   
swaps// sort variable sized array; 1

[11]

**77.** (a) (i) A HardwareItem   
B EquipmentLoan 2  
C ‘is out on’ ; *accept any wording with similar meaning*

**R** one to many relationship

(ii) Entity-Relationship Diagram; **A** E-R diagram; 1  
**A** E-R D **R** E-A-R diagram

(b) CREATE TABLE HardwareItem

|  |  |  |
| --- | --- | --- |
| (Description VARCHAR (30) | |  |
| Make VARCHAR(15) | 1 mark **A** text/string instead of char/varchar | |
| Model VARCHAR(15) | |  |

(Inventory)RefNo CHAR(20) PRIMARY KEY, 1

|  |
| --- |
| **A** string/text/character/VARCHAR(20) instead of CHAR(20) |

PurchaseDate DATE,

|  |
| --- |
| **A** DateOfPurchase DATE **A** Date/Time instead of Date |

PurchasePrice CURRENCY, 1

Location VARCHAR(4))

|  |
| --- |
| **A** DECIMAL/MONEY/Number/Real/Float/Single instead of CURRENCY |
| **A** Room VARCHAR(4) **A** INT/number instead of VARCHAR |

Alternative for InventoryRefNo:

|  |
| --- |
| **A** VARCHAR(20) instead of CHAR(20) |

(Inventory)RefNo CHAR(20), PRIMARY KEY(InventoryRefNo),  
(Inventory)RefNo CHAR(20), NOT NULL,, PRIMARY KEY(InventoryRefNo),

*Note: string lengths do not have to be exact/present except for InventoryRefNo*

CREATE TABLE EquipmentLoan

(Inventory)RefNo VARCHAR(20),

|  |
| --- |
| **A** NOT NULL |

|  |
| --- |
| *If not DDL but composite key identified, give 1 mark* |

Location VARCHAR(4),  
(Staff)Initials VARCHAR(3), 1  
DateRemoved DATE,

|  |
| --- |
| **A** NOT NULL |

DateReturned DATE,  
PRIMARY KEY (InventoryRefNo, DateRemoved), 1  
FOREIGN KEY (InventoryRefNo) REFERENCES HardwareItem  
(InventoryRefNo)) 1 6

|  |
| --- |
| **P1** for extra attributes |

(c) SELECT (HardwareItem.)Description, (EquipmentLoan.)DateRemoved, 1  
EquipmentLoan. (Inventory)RefNo, 1

|  |
| --- |
| **A** HardwareItem.InventroryRefNo |

FROM HardwareItem, EquipmentLoan 1  
WHERE HardwareItem. (Inventory)RefNo = EquipmentLoan.  
(Inventory)RefNo 1  
AND (EquipmentLoan.)DateRemoved > givenDate 1

|  |
| --- |
| **A** > =  **A** = > |

ORDER BY (EquipmentLoan.) (Inventory)RefNo; 1

**or**SELECT (HardwareItem.)Description, (EquipmentLoan.)DateRemoved, 1  
EquipmentLoan. (Inventory)RefNo 1

|  |
| --- |
| **A** HardwareItem.InventroryRefNo |

FROM HardwareItem   
INNER JOIN EquipmentLoan 1

|  |
| --- |
| Note: can swap tables |

ON HardwareItem. (Inventory)RefNo = EquipmentLoan. (Inventory)RefNo 1  
WHERE (EquipmentLoan.)DateRemoved > givenDate

|  |
| --- |
| **A** > =  **A** = > |

ORDER BY (EquipmentLoan. )(Inventory)RefNo; 6

|  |
| --- |
| **A** HardwareItem.InventroryRefNo |

[15]

**F/T** with attribute names  
**P1** for tbl prefix  
**P1** if table name after attribute name  
**I** extra punctuation

**78.** (a) LAN; because the buildings are on one site 2

(b) (i) pupils benefit: can access their work/resources on any computer;   
can print on any printer;   
can access information from any computer;  
can use VLE/intranets/shared folder;  
can submit work over network; 1

|  |
| --- |
| Some answers can occur in more than one section but can only be awarded once  Ignore references to Internet |

(ii) teacher:   
 can access pupil database/information from any computer;  
 can register pupils from any computer;  
 internal e-mail/communication between staff or between staff   
 & pupils;  
 monitoring useage of network; 1

(iii) head of year / personal tutor: can access pupil attendance data directly;  
 can access pupil database from any computer;  
 internal e-mail/communication between staff or between   
 staff & pupils; 1

(iv) head / principal: can get stats of attendance (more easily);  
 can get stats of pupils (on courses) (more easily);  
 internal e-mail/communication between staff; 1

(c) 1 mark for PC/workstations linked to hub;  
1 mark for 15 PCs connected to hub(s);

|  |
| --- |
| If hubs incorrectly labelled but topology ok, give 1 mark |

1 mark for hub to hub links (if all PCs connected to 1 hub give 1 mark for this); 3



*components must be labelled. Accept PC/Computer as equivalent label  
no arrows needed for physical diagram  
allow connection between hubs via backbone  
Accept hubs connected via another hub****R*** *link via server  
Ignore a server connected to bus or hub*

(d) (i) hub: collision domain involves all computers connected to hub;   
switch: collision domain limited to 2 computers;  
hub broadcasts packet to all computers; switch only sends packet   
to receiver; 2

(ii) no collisions possible with a switch // collisions reduced; 1

(e) to prevent unauthorised access to a private network  
// to safeguard the school’s network against hackers  
to prevent unwanted intrusion from outside internal network;  
to block internal access to specific external sites;  
block certain ranges of IP addresses;  
close ports; max 2

**R** references to viruses

[14]

**79.** (a) bus;  
**R** line 1

(b) star; 1

(c) (i) (*Advantage:*) (*Reason:*)  
lower cost// reduced cabling//  
more flexible; easy to add/remove stations;

**A** advantage and reason swapped round  
**A** cheaper  
**R** Easier to set up 2

(ii) (*Advantage:*) (*Reason:*)

if one cable/wire fails it affects as each computer is directly  
only one computer// connected to central computer//  
simple to isolate faults// as messages are sent directly  
different computers can transmit at different to central computer;  
speeds// system more secure// **A** each computer has its  
 own line;  
network does not degrade when  
highly loaded;

**R** collision free *unless explained*  
**R** easy to add / remove computers  
**R** reliability **R** faster  
**R** computer/node failure

**A** advantage and reason swapped round

*Reason mark not dependent on gaining advantage mark* 2

[6]

**80.** (a) x  5  
y  3  
Result  1  
REPEAT  
 Result  Result \* x  
 y  y – 1

UNTIL y=0

|  |  |  |
| --- | --- | --- |
| **x** | **y** | **Result** |
| 5 | 3 | 1 |
| **5** | **2** | **5** |
| **5** | **1** | **25** |
| **5** | **0** | **125** |

1 mark for each entry in column Y (max 3)

1 mark for each entry in column Result (max 3)

1 mark for not changing value of x (max 1) 7

(b) calculate 53 // calculate 5×5×5 // calculate x3 // calculate xy //  
multiply x by itself y times; 1

[8]

**81.** (a) Cables are cheaper // uses fewer wires;  
Data does not get skewed // out of line/sync;  
Simpler/cheaper/easier to boost signals;

**R** Cheaper on its own (n.e) 2

(b) (i) baud is the number of signal / pulses / voltage changes per second;  
**A** rate at which signals / pulses are sent;  
**A** rate at which voltage changes; 1

(ii) number of bits per second / bits per unit of time;  
bit rate = baud rate \* number of bits per signal change;  
**R** rate at which bits are sent 1

(iii) range of frequencies that can be transmitted; 1

(c) greater bandwidth allows greater bit rate; 1

[6]

**82.** (a) To support programs / processes which are non-sequential in nature;  
To deal with a number of events which happen in parallel;  
To deal with events at unpredictable moments in time;  
To carry out processing and produce a response within a specified  
interval of time;  
To produce output fast enough to effect next input; 3

1 mark per requirement to max 3

(b) Process control system  
Booking system;  
Expert system;  
**A** specific example of a type of system 1

1 type of real time computing systems

[4]

**83.** (i) allow addresses in the Pointer column. 3



(ii) array; of records; *OR* linked list; of records; *OR* 4 1-D arrays;  
one for each column; *OR* one 1-D array for process name;  
one 2-D arrays for numerical data; 2

(iii) *Marks to be allocated as follows*: 4

*1 for initialisation* ListPointer  HeadPointer;  
*1 for while not at end of list* While ListPointer <>-1 Do;  
*1 for printing* Print ListArray[ListPointer].Name;  
*1 for getting next pointer* ListPointer  ListArray[ListPointer].Pointer; *P1 if headpointer is reassigned*

Any name acceptable for ListPointer and ListArray

Note: a sorting method gets a maximum of 3 marks (inefficient)

*Alternative solution*REPEAT UNTIL next=-1 OR IF listpointer <>-1 then REPEAT..

(iv) 2

|  |  |
| --- | --- |
| *List* | *Reason* |
| List of suspended/blocked/halted/ unrunnable processes; | waiting for a resource or complete a requested I/O transfer; |
| List of inactive/dormant jobs; | Waiting to be admitted to the system; |

**I** currently running processes **I** interrupt

[11]

**84.** (a) produces re-useable code because of inheritance/encapsulation;  
Produces re-useable objects;  
data is protected // only accessible in well-defined ways (because of  
encapsulation);  
more efficient to write programs which use pre-defined / inherited  
objects / classes;

storage structure of data and method code of a class may be altered without  
affecting programs that make use of the class;

code produced contains fewer errors / more reliable;

solutions are easier to understand (when expressed in terms of objects);

easier to enforce design consistency; easier to debug;

less maintenance effort required by developer since objects can be re-used;

new functions can be added to objects easily (because of inheritance);

**R** Easier to program 2

**I** references to GUIs

(b) *1 mark for correct base class and derived classes incl. containers;*

*1 mark for 2 correctly directed arrows;* 2

|  |
| --- |
| **R** E-R diagrams **I** methods listed in containers |

(c) Member = Class  
(Public)

(procedure) AddNewMember(s); }  
(procedure) AmendMember(s) } ; *no mark if methods are private*(Procedure) ShowMember(s); }

|  |
| --- |
| **A** proc instead of procedure **R** function instead of procedure |

Private ; *1 mark for all data fields marked as private*

MembershipNo : Integer } **A** string/text *as data type* **R** number  
FirstName: string/text };  
Surname: String/text }

|  |
| --- |
| **A** ID  **A** FName  **A** SName  **A** Tel |

TelephoneNumber: string/text : **R** *number/integer as data type* 4

End (Class)

Public may come after Private. Each line may be preceded by Public or Private & in no particular order **R** diagrammatic answer **I** case **I** white space

[8]

**85.** (a) BE4; 1

must be capital letters

(b) 190.25 / 190 ¼ ;; 3

one mark for correct integer part,  
one mark for correct fractional part  
one mark for correct working  
(e.g. correct place values)

(c) –1052;; 2

1 mark for workings if result incorrect  
1 mark for sign, 1 mark for 1052

(d) (i) -8.25 / -8¼;;; 3

partial marks for workings if result incorrect

1 mark for sign, 1 mark for moving binary point 4 places or showing 24

(ii) starts with 1 0  
the first 2 binary digits are different;  
a significant bit is stored after the (implied) binary point;  
bit after (implied) binary point different from bit before binary point; 1

**A** all leading 1’s have been removed // there are no leading 1’s;  
**R** there are no leading zeros

[10]

**86.** (a) One channel system // single signal sent thro’ bandwidth //  
single stream of data;  
Whole bandwidth dedicated to one data channel;  
**R** Single signal sent at a time on its own  
**R** Uses single frequency 1

(b) Multi-channel system // several signals sent simultaneously //  
several signals sent using different frequencies;  
Several channels combined onto a carrier signal;  
Bandwidth shared by several data channels;  
**A** Multiple signals sent at a time on its own 1

(c) Transmitter and receiver keep in step at all times  
(by transmitter transmitting synchronising signals periodically). 1

[3]

**87.** (a) WAN 1

(b) Software cannot be copied;  
Customer does not have to keep track of/worry about illegal copies of  
product on its computers;  
The elimination of staff and systems to distribute products;  
Help-desk support is simplified when all customers are using the same  
centrally managed, shared software;  
Smaller software development team because different flavours of a product  
do not have to be developed for customers with different machines, OSs;  
Cheaper implementation of improvements, as new software versions only  
have to be placed on central server;  
Faster implementation of improvements, as new software versions only  
have to be placed on central server //Updates available immediately//Instant  
delivery – no postal delay;  
The elimination of customisation, which means that system integration  
becomes simpler;

**A** more efficient feedback loop for getting users’ views of suggested enhancements;

Reduces customers’ hardware costs;  
Reduces customers’ storage/hard disk space requirements;  
Reduces customers’ maintenance support (handling updates//  
configuring software) requirements;  
Access from any computer connected to Internet/network; 3

**A** Software cheaper because ....  
**R** Don’t have to pay for updates;

[4]

**88.** (a) **I** Minor spelling

(i)  1

(ii)  1

(iii)  1

(b) Penalise table name. field name in reverse order once

**R** Quotes and additional constructs  
**I** Table names unless in wrong order or wrongly expressed

(i) Select FirstName, Surname  
 From Student; 1

(ii) Select Student.FirstName, Student.Surname,  
 MarkAwarded.Mark;

**I** table names unless incorrect

From Student, MarkAwarded;  
Where MarkAwarded.LifeCyclePhaseID = 1;  
 And Student.StudentID = MarkAwarded.StudentID ;

**I** table names unless incorrect

Order By Student.Surname; 5

**I** table names unless incorrect

Order By Student Surname Asc  
**A** Ascending  
Asc/Asending must be in correct position  
**A** OrderBy

[9]

**89.** (a) **A** set of rules/procedures; 1

(b) Bus; **R** Ethernet on its own 1

(c) Twisted pair//coaxial (cable)//optical fibre//fibre optic; 1

(d) Need first octet or first and second octet or first, second and third octet  
to be identical. Also must have four octets.  
For example:

**R** without full stops

192.168.0.1  
192.168.0.2  
One mark for four octets;  
One mark for same LAN; 2

(e) (Use candidate’s example from (d))

(i) 192.168.0; 1

(ii) 1 or 2; 1

(f) a (unique) address/identifier assigned to network card // (unique) hardware  
address/identifier; 1

(g) Any two tasks @ one each  
Allocation of port numbers;  
Routing a packet/frame/segment to correct application/service;  
Splitting messages/data into packets // Disassembling messages //  
Assembling packets;  
Adding TCP headers // Adding sequence nos;  
Error handling // sets parity bits;  
Checking that transmission successful;  
Resending transmission if necessary;  
**A** Sets packet size; 2

(h) Any one of the following applications for one mark;  
Telnet;  
Internet browser;  
http (client) // web server;  
email;  
FTP;  
TFTP;  
SMTP;  
**R** Non-networked applications such as word processor 1

(i) Internet Registry // Internet Registrar;  
**A** I.P. Registry/Registrar 1

[12]

**90.** (a) (i) Name: Start Bit;  
Purpose: Synchronise receiver; 2

(ii) Name: Parity Bit;  
Purpose: Perform parity check// check for errors in transmission;  
**A** Prevent errors 2

(iii) Name: Stop Bit;  
Purpose: Allow start bit to be recognised//  
Allow receiver to process received bits;  
**A** Indicates end of data 2

(b) (i) the number of signal/voltage changes per second;  
**A** rate at which signals are sent;  
**A** rate at which voltage changes; 1

(ii) number of bits per second / unit of time;  
**R** the rate at which bits are sent *(question paraphrased)* 1

(iii) Range of frequencies a channel can handle;  
**A** maximum line speed; **A** maximum transmission speed; 1

(c) A signal can contain one or more bits;  
Bit rate can be higher than baud rate;  
bit rate = baud rate \* number of bits per signal change;; 2

[11]

**91.** (a) (i) First In First Out; or by description

(ii) Last In First Out; or by description 2

(b)

|  |  |  |
| --- | --- | --- |
|  | FIFO | LIFO |
| Queue |  |  |
| Stack |  |  |

2

(c) Reverse the contents of a queue/list;  
Push all contents of queue/list onto stack then pop them off into a new  
queue/list;  
Procedure/function calls;  
Local variables;  
Parameters;  
Return Address;  
Volatile environment; **A** register contents  
State 1 Describe 1 2

(d) list of elements inserted into tree;  
to allow rapid/fast searching of the data;  
to output sorted/ordered data; 2

[8]

**92.** (a) (i) world-wide collection of networks/computers using TCP/IP;  
world wide collection of networks/ gateways/ servers/ computers  
using a common set of telecommunications protocols to link them  
together;  
world-wide collection of networks/ computers using the same protocol;  
world-wide collection of networks/computers using a standard protocol; 1

(ii) collection of servers using Hypertext Transfer Protocol/HTTP//  
collection of data files/ documents using Hypertext Mark-up  
Language/ HTML/ XHTML/ XML; 1

(iii) computers connected within a small geographical area/building/site;  
**A** computers connected using local area network/LAN protocols; 1

(iv) computers connected over a large geographical area;  
**A** computers connected using wide area network/WAN protocols; 1

(v) Network providing Internet facilities within an organisation/  
LAN using Internet protocol; 1

(b) (i) any valid domain name, e.g. aqa.ac.uk; **R** www.aqa.ac.uk 1

(ii) any valid address in the range 0.0.0.0 to 255.255.255.255; 1

[7]

**93.** (a) 1 mark for each correct entry 6

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Values | | | | |
| New | Last | Ptr | [1] | [2] | [3] | [4] | [5] |
|  |  |  |  | **max** | **6** |  |  |
| 6 | 3 | 1 | 4 | 7 | 9 |  |  |
|  |  |  |  | **max** | **1** |  |  |
|  |  | 2 |  |  |  |  |  |
|  | 2 |  |  |  |  | 9 |  |
|  | 1 |  |  |  | 7 |  |  |
|  |  |  |  | 6 |  |  |  |

(b) Insert 6/a value into the array/ in the correct position; 1

[7]

**94.** (a) (i) Collection of tables / Linked tables; 1

(ii) Relationships are modelled by shared (common) attributes;  
*BoD field*//primary key & foreign key; 1

(b) (i) Not necessarily unique; 1

(ii) TownName 1

(iii) To speed up searching 1

(iv) They slow down data entry / editing; **A** system 1  
because indices have to be updated each time a record is  
added / deleted; 1

**A** Indices take up more space;

(c) (i) *Suitable input method* 1  
Mousepad / trackpad built into a desk;  
/ Touch sensitive screen;  
**R** keyboard, mouse, anything not fixed.

(ii) *Software Feature:* 1  
Drop down menus /Index;  
Zoom feature / Thumbnails which expand on click  
Hotspots/Hyperlink /Navigation Bar / Tabbed pages /Forward  
and back icons;  
Ability to enter details to narrow down search;  
**R** Scroll bar

(iii) *1 mark for each of 2 requirements: (Must be in context)* 2  
Access to help screen;  
Ability to zoom in / large text for partially sighted / choice of text size;  
Ability to have instructions in other languages;  
Careful choice of colours;  
Ease of navigation;  
Other points if justified (not *clear* *instructions*);

[11]

**95.** Compare Pascal with middle item of list / Lisp;  
Compare Pascal with middle item of upper sublist / Prolog;  
Compare Pascal with Pascal // compare only item in this sublist to get a match; 3

*Lose 1 mark if Pascal not explicit in comparison*

***stop marking from time it goes wrong***

OR

List[4] = Pascal? False; **A** [4] = Pascal **R** 4 = Pascal

List[6] = Pascal? False;

List[5] = Pascal? True; 3

if formula explicit, follow through on formula

[3]

**96.** (a) 140 ¼ ;; *one mark for correct integer part,*

140.25;; *one mark for correct fractional part* 2

(b) (i) -14.5;;; *give 2 marks for 14.5* 3

*partial marks for workings if result incorrect:*

1 mark for negative number;  
1 mark for x24 (accept 16 instead of 24);  
**A** showing that binary point moves 4 places right;

(ii) leftmost 2 digits/bits are different;  
a significant bit is stored after the binary point;  
bit after point different from bit before point;  
(negative number) starts with 10…  
(positive number starts with 01)….; max 1

**A** the first but after the sign bit is a ‘0’;  
**A** The second bit is a ‘0’;  
**A** an answer that clearly implies a ‘0’ follows the ‘1’

(iii) to maximise accuracy/precision for a given number of bits  
// to minimise rounding errors;  
**A** more accurate/precise for a given number of bits;  
a given number can only be expressed in one way in a given  
number of bits  
// a given number can only be expressed in one way in a given format;  
to simplify arithmetic/logical operations; 1 **I** range

[7]

**97.** (a) a class has properties/fields/attributes/characteristics and  
methods/procedures/functions of the parent class it is derived from  
// a subclass/derived class inherits all the properties/fields/attributes/  
characteristics and methods/procedures/functions from a  
super-class/base-class/parent class; 1

(b) StockItem (=) Class **//** Class (=) StockItem;

1 mark for keywords Class and StockItem

(**A** Object instead of Class)



Book = Class (StockItem) // Class Book extends/derives from StockItem

// Book Subclass: StockItem;

**A** without keyword Class



End



*No marks for a diagrammatic answer*. **I** *method parameters* max 7

Java version:

Public Class StockItem

{

Private String title;

Private boolean onLoan;

Private String dateAquired;

Public void displayDetails ();

Public void setLoan ();

}

Public Class Book extends StockItem

{

Private string author;

Private string isbn;

Public void displayDetails ();

}

Public Class CD extends StockItem

{

Private string artist;

Private integer playingTime;

Public void displayDetails();

}

[8]

**98.** (a) it calls itself / is defined in terms of itself / contains within its body a  
reference to itself; 1

Ensure ‘it’ refers to procedure, if meaning program or object no mark

(b) the current state of the machine is saved/preserved;  
 so can return correctly (to previous invocation/call of **Process)**;

*or*

return address / procedure parameter / status register / other register  
values / local variables must be saved/preserved;  
so can return correctly to “*correctly’ can be implied*(previous invocation of Process); 2

(c) Printed Output:

1; 3; 5, Bird; Bremner; 4, Fortune, Jones; 2, Smith; 6

mark from left and stop marking when error encountered

ignore punctuation.

(d) (in-order) traversal of a tree; **A** printing of tree (elements in order) 1

**I** wrong order

[10]

**99.** *accept Immediate Access Store or IAS as an alternative to main memory*

(i) hard disk / secondary memory;  
**R** backing store **R** hard drive 1

(ii) (used when execution of a program/process)  
not enough main memory / RAM / physical memory;  
to run process(es) // load program(s) // allocate data area; **A** store  
**R** computer fooled into thinking more main memory max 2

(iii) physical/main memory/RAM is conceptually divided into a number of  
(fixed size) page frames; **A** pages/segments;

(virtual address space of) program/process is divided into a number  
of (fixed size) pages;

page table indicates which pages of process are loaded (and where);

**A** page table keeps track of pages

pages are swapped between disk/secondary memory and main  
memory as required //

pages are swapped into, and out of, main memory as required; max 2

No marks for a point which references just data when  
it should reference a program

backing store is not acceptable as a substitute for disk

[5]

**100.** (a) External/User/Local (schema);  
Conceptual/Logical/The schema;  
R. Internal/Storage (schema)  
R. System Schema 2

(b) Any one @ one mark each  
 Create Table;  
 Create View;  
 Create Index  
 Create Unique Index;  
 Create Domain;  
 Create Database;  
 Create Trigger;  
 Alter Table; max 1

(c) (i) Collection of tables/relations (A. anything that suggests multiple tables);  
R. Entities  
R. Files 1

(ii) Collection of Objects;  
A. Collection of properties/attributes/fields + methods;  
A. Collection of instances of a class/classes  
R. Collection of classes 1

[5]

**101.** (a) Contains a repeating group;  
Or  
Cells for one or more of SubjectID, SubjectName,  
ExamBoardSubjectOfficerName,  
NumberOfCandidatesEntered contain multiple values;  
R. Repeating attributes, etc 1

(b) Attribute names must not be redefined (exception: allow Center).  
One mark for attributes(lose this mark if extra attributes), one mark for  
correct primary key



Penalise misspelling once

(c) (i)



(ii)



(d) I. Inner join, Join  
A. Without commas  
R. Brackets in Select and anywhere else except:  
A. Brackets around (DateReported < 1/3/2005) and (ExaminationOfficer.CentreNo=Problem.CentreNo) as shown  
Asc is optional but if present it must be at end of **Order By** line  
(A. Ascending) Max 5

Penalise brackets once



(e) R. Brand names  
word processor//word processor with e-mail support; 1

[15]

**102.** (a) (i) Wide area network is a set of links that connect together geographically  
remote computers;  
R. Definition that doesn’t reference “connects computers.....and geographically remote” 1

A. Hosts/Nodes/Devices for computers

A. far apart/Large distance/large geographical area

R. > some measurement, e.g. 2km

(ii) Networking based on virtual circuits established across a wide area  
packet switched network;  
Networking which specifies the nodes or pathway through a  
packet-switched network before transmission begins so that no  
routing decisions need to be taken for each packet at each node  
during transmission;

A. Network that guarantees packets will arrive in the order that  
 they are sent;

R. Network that uses cells

R. Quality of Service max 1

(iii) The data-carrying capacity of the medium is divided into (fixed size)  
time-slots, with a time-slot assigned to each data stream;

A. Clearly labelled diagram max 1

(b) One mark for central hub and one mark for computers connected to hub  
as shown

NB If hub incorrect answer scores zero  
If hub correct but computers incorrect answer scores one mark  
Router can be replaced by a computer labelled with router’s 2  
IP address



Don’t have to label computers with their IP addresses.  
A. IP addresses in place of computers + router

Don’t have to label server if drawn as shown

(c) So that these are reachable from anywhere on the Internet//so that can be  
seen/reached from the world outside;

A. So that they can be uniquely identified.  
R. So can be reached by another branch of company 1

(d) Document(Web page) split into smaller chunks;  
A. segments/packets/frames  
Destination IP address doesn’t match this  
segment’s IP address so document chunks sent to nearest router/default  
router/gateway;  
Using nearest router’s network card address/MAC address;  
Router sends chunks to router connected to web server segment using  
its routing tables;  
And using network card address of router connected to web server;  
This router sends chunks to Web Server;  
Web server rebuilds document;  
End to end connection established//port/socket connections made; max 5

(e) To block access to/from the internal private network from/to the  
Internet/world outside;  
To stop/limit/block/restrict certain kinds of access to the Web server,  
e.g. telnet;  
To close ports to prevent users from connecting to them;  
To block connections on unwanted ports;  
To prevent unauthorised access to the private computers;

A. Filtering  
R To stop hackers (must state more than this = one of the above answers) max 1

(f) A network in which resource security/user authentication/  
administration/resource allocation;  
managed/controlled by/carried out by servers;  
OR  
A network in which servers provide specialist services  
(A. specific servers e.g. web servers) ;  
for client computers;  
OR  
Shared information stored on servers;  
rather than individual PCs/client computers; 2

(g) A database server is software/computer that processes SQL  
requests from client computers returning results to the clients across  
a network or using network protocols (the data resides on the same  
machine as the database server);  
Client requests data from server, server responds with data  
(require request, data and response); max 1

Database server listens on a particular port for client requests.  
TCP/IP protocol used.

[15]

**103.** (a) data bus; carries data to/from processor / memory / devices /  
 components;

address bus; carries addresses / identifies locations;

control bus; carries control signals / controls devices;

**A** by example  
maximum 1 mark for carries Data / carries addresses / carries control signals 6

(b) network adapter / network card;  
**A** named example e.g ethernet card  
generate / understand signals / data (that conform to the LAN protocol) /  
Allows (successful) communication / Provides a unique network address;  
**R** connect 2

(c) Faster transmission; 1

(d) Data transmitted longer distance than is possible with parallel /  
less expensive to cable;  
**R** cheaper 1

[10]

**104.** (a)  


1 for connections; 1 for directions; 2

(b)  


1 for connections; 1 for directions; 2

[4]

**105.** (a) world-wide collection of networks/ computers using the same protocol;  
world-wide collection of networks / computers using a standard protocol;  
world-wide collection of networks / computers using TCP/IP;  
world wide collection of networks / gateways / servers / computers using  
a common set of telecommunications protocols to link them together;  
max 1 1

(b) Name used to reference Internet connected computer /  
User friendly reference that maps to an IP address;  
**R** Web site name / address  
**R** example 1

(c) Network providing Internet facilities within an organisation /  
LAN using Internet protocol; 1

(d) Protocol used + address of resource (in two parts: the server and  
then the path to the resource on this server) / Uniform Resource Locator;  
**R** example 1

(e) Numerical address / Stored in 4 bytes / Range 0.0.0.0 to 255.255.255.255/  
Used to identify an individual computer / Internet Protocol address;  
**R** example 1

[5]

**106.** (a) Last In First Out; 1

(b) (i)  1

(ii)  1

(iii)  1

(iv)  1

(c) To reverse elements/ pass parameters/ store volatile environment;  
**A** store return address 1

[6]

**107.** ISBN; 1  
unique identifier; 1  
**R** unique to books 2

[2]

**108.** (a) Unauthorised access to } computer programs or data;  
Unauthorised modification of } computer material;  
Unauthorised access with criminal intent; 2

1 mark for each to max  
Wording must be close

(b) Guidelines / policy on choosing passwords which are not easily guessed;  
Keeping a log of all movements on confidential files;  
System should disable keyboard after 3 wrong passwords have been entered;  
Additional passwords should be required to access / alter important files;  
Encrypt sensitive files;  
CCTV used as a deterrent;  
Swipe / smart card for access;  
Biometric logon (**A** once);  
Some software only available on certain computers; 3

1 mark for each to max

[5]

**109.** (a) (i) An attribute/field which uniquely identifies a record; 1

(ii) LecturerID; 1

(b) (i) A attribute/field in one table which is the primary key in another table; 1

(ii) LecturerID; 1

[4]

**110.** (a) B76; **R** lower case B 1

(b) 1833/8 ;;  
183.375;; 2

one mark for correct integer part,

one mark for correct fractional part

(c) (i) -36.5;;; 3  
*partial marks for workings if result incorrect:  
1 mark for x26; accept showing that binary point moves 6 places right;  
1 mark for negative number;*

(ii) a significant bit is stored after the binary point;  
bit after point different to bit before point;  
negative number starts with 10… positive number starts with 01….;  
to max 1

(iii) to maximise accuracy / number stored with maximum precision;  
**A** more accurate;  
a given number can only be expressed in one way in a  
given number of bits; 1

[8]

**111.** (a) it calls itself / is defined in terms of itself / is re-entrant   
/ contains within its body a reference to itself; 1

Ensure ‘it’ refers to procedure, if meaning program or object no mark

(b) the current state of the machine must be saved/preserved   
so can return correctly to previous invocation of B;

*or*

return address / procedure parameter / status register / other register values /   
local variables must be saved/preserved so can return correctly to   
previous invocation of B**)**; 1

(c)

|  |  |  |
| --- | --- | --- |
| Call Number | Parameter |  |
| 1 | 53 |  |
| 2 | 26 |  |
| 3 | 13 |  |
| 4 | **6** | **;** |
| 5 | **3** | **;** |
| 6 | **1** | **;** |

Printed Output: 1 1 0 1 0 1;;; 6

one mark for each correct pair of bits  
mark from left and stop marking when error encountered  
ignore punctuation. if more than 6 bits give a max of 2 marks

(d) conversion (of a denary number) into binary; 1

[9]

**112.** Compare Newcastle with (middle item of list), Manchester;  
Compare Newcastle with (middle item of upper sublist), Sheffield;  
Compare Newcastle with Newcastle // compare only item (in lower sublist  
of this upper sublist) to get a match;

Lose 1 mark if Newcastle not explicit in comparison  
stop marking from time it goes wrong

*or*

List[4] = Newcastle? False; **A** [4] = Newcastle **R** 4 = Newcastle  
List[6] = Newcastle? False;  
List[5] = Newcastle? True;

if formula explicit, follow through on formula

[3]

**113.** (a) (i) sequence of execution of instructions determined by programmer;  
**R** user *instead of* programmer **R** a specific order  
Example: Pascal/Fortran/Basic/ C/C++/Cobol/Algol; **R** Visual… 2

(ii) program is a set of facts and rules   
// programmer declares what has to be done but not how to do it;  
Example: Prolog/LISP/SQL; 2

(iii) execution of code dependent on an event such as user clicking mouse;  
Example: Visual Basic / Delphi / C#/ Java /Smalltalk/ Visual C++;   
Visual ….; **R** VB 2

(b) (i) joining together of code/procedures/methods  
and data/properties/characteristics/record/attributes into objects;to max 1

(ii) Member (=) Class **//** Class (=) Member 4

1 mark for keyword Class; 1 mark for Member;

(**A** Object *instead of* Class)

Public

1 mark for keyword Public in context;

(procedure) AddNewMember(Details);  
(procedure) Amend(Member)Details;  
(procedure) Display(Member)Details;

1 mark for correct procedure definitions;

Private

1 mark for keyword Private in context;

Surname: String; **A** protected;  
Firstname: String;*;*TelephoneNumber: String;  
Handicap: integer; **A** text *instead of* string

1 mark for correct data fields & data types  
don’t allow extra fields

End;

No marks for a diagrammatic answerto max 4

[11]

**114.** (a) (i) the concurrent execution // apparent simultaneous execution  
(over the same time period) of two or more tasks // the concurrent  
execution of a group of co-operating/a single user’s tasks;  
**A** programs/processes **R** jobs / applications  
between which communication is possible // to achieve some  
common goal;  
**R** descriptions which imply multi-user or batch O.S. 2

(ii) memory on hard disk;  
(used when execution of a program/process)   
where total virtual address space exceeds / program and data /  
main memory needed exceed the physical/main memory capacity;  
to store pages (of the process) / parts of the process not currently needed;  
**A** program *instead of* process  
lets user think there is more main memory/RAM // not enough  
main memory;  
**R** computer fooled into thinking more main memory  
**A** disk is used as RAM;to max 2

(iii) physical memory/RAM is conceptually divided into a number  
of (fixed size) page frames; **A** pages/segments;  
(virtual address space of) program/process is divided into a number  
of (fixed size) pages;  
page table indicates which pages of process are loaded (and where);  
**A** page table keeps track of pages;  
pages are swapped between disk and main memory as required  
// pages are swapped into, and out of, memory as required;

No marks for a point which references just data when it should reference a program backing store is not acceptable as a substitute for disk

to max 2

(b) (i) a thread is the processing performed on a single set of data in the system;  
a thread is a process that shares most of its environment;  
threads may be distinguished only by the value of their program  
counters and stack pointers;  
several threads share one copy of program code;  
a thread executes in the address space of its parent process;  
sharing global variables but with its own local variables;  
a thread is a line of execution within a process; it has its own  
program counter,  
stack pointer and register values but runs in the same address  
space as other threads in the process; 2

(ii) threads have access to the same memory so they can communicate easily;  
multi-threading allows threads to access the same data as they  
can access the same area of memory (RAM), separate processes  
do not allow this as they are self-contained;  
only one copy of the program needs to be loaded;  
saves main memory;threads share more of their environment with each other  
than do processes;  
faster execution than separate processes // faster execution overall;

Allow carry forward/back between (i) and (ii)

to max 1

[9]

**115.** (a) Contains a repeating group;  
*or*One or more of RouteId, RouteName, RouteArea, RouteDescription contain  
multiple values; 1

(b) Attribute names must not be redefined

(i) Leaflet 2

(ii) Route  
  3

(c) 1  


(d) **I.** Inner join, Join  
Asc is optional but if present it must be at end of **Order By** line (**A**. Ascending)  
 Penalise **And** once in this line  
 **R.** If And used  
 **I.** Quotes/hashes/Absence of separators  
  


*or*











Candidate may use relation name in front of attributes, eg. Select Person.Surname

Asc is optional  
to max 6

(e) **R**. Brand names

(i) word processor//word processor with e-mail support; 1

(ii) desktop publishing; A. publishing package or anything with publishing 1

(iii) spreadsheet; **R**. Database & spreadsheet  
**R**. Finance package. **R**. Accounting package 1

[16]

**116.** (a) To exchange/transmit business documents electronically( Accept invoices /  
(purchase) orders/catalogues);  
**R.** To exchange data. **R.** Stock control 1

(b) Wide area network is a set of links that connect together  
geographically remote computers;  
**R.** Definition that doesn’t reference “connects computers.....” 1

(c) (i) **R.** Quicker to set up.... (Time is not an issue).  
Accept disadvantage that can be mapped to an advantage.  
No expertise required to manage the wide area network;  
Lower costs applied to something reasonable, e.g. setting up, managing, maintaining; **R.** Lower costs on its own  
Availability of a help desk;  
Conversion between standards possible;  
Common standard enforced by VAN;  
Software provided by VAN for document conversion;  
to max 1

(ii) More secure;  
More difficult to tamper with a transmission;  
Reliable authentication;  
to max 1

(d) One mark for central hub and one mark for computers connected to  
hub as shown  
NB If hub incorrect answer scores zero  
If hub correct but computers incorrect answer scores one mark  
Router can be replaced by a computer labelled with router’s IP address 2



Don’t have to label computers with their IP addresses.  
**A.** IP addresses in place of computers + router

(e) So that these are reachable from anywhere on the Internet//so that  
can be seen/reached from the world outside;  
**R.** So can be reached by another branch of supermarket 1

(f) Document split into smaller chunks; A. segments/packets/frames  
Destination IP address doesn’t match this segment’s IP address;  
Document chunks sent to nearest router;   
Using its network card address/MAC address;  
Router sends chunks to router connected to print server segment;  
Using its routing tables and;  
This router’s network card address;  
This router sends chunks to print server;  
to max 5

(g) To block access to/from the internal private network from/to the Internet;  
To stop certain kinds of access to the Web server, e.g. telnet;  
To close ports to prevent users from connecting to them;  
To block connections on unwanted ports;  
To prevent unauthorised access to the private computers;  
**A.** Filtering  
to max 1

(h) A network in which resource security/user authentication/  
administration/resource allocation;  
managed/controlled by/carried out by servers; 2

[15]

**117.**   


(a) correct position of Louise;  
correct position of Christine and Peter;  
correct position of Alan and Leslie;  
correct position of Maria and Robert; 4  
*(If consistent mirror image give full marks)*

(b) Root node marked correctly; 1

(c) Louise, Peter, Maria in correct order (allow follow through from (a)); 1

[6]

**118.** (a) (i) Local Area Network; 1

(ii) Wide Area Network; 1

(b) (i) Intranet // Any example of communication within a building or site;  
**I** Connection of computers 1

(ii) Internet// World Wide Web //   
Any example of communication over a substantial distance;  
**I** Connection of computers 1

(c) (i) A set of rules; 1

(ii) The rate that signals/ voltage changes are transmitted; 1

(iii) The number of bits transmitted per second//  
the number of bits transmitted per time unit;  
**R** the rate that bits are transmitted;  
**R** bits of data 1

(iv) The range of frequencies a medium is capable of transmitting; 1

(d) Greater bandwidth allows greater bit rate // bit rate proportional to bandwidth; 1

(e) (i) Bits transmitted one after the other (along a single channel/ wire/ line);  
Or by diagram  
**R** Bits of data 1

(ii) Bits transmitted (along several wires/ channels/ lines) at the same time;  
Or by diagram 1

(iii) Can be transmitted over a longer distance// cabling is cheaper //  
Less chance of skew; 1

(iv) Faster transmission; 1

[13]

**119.**

|  |  |
| --- | --- |
| Result | Index |
| 0 | 0 |
| 24 | 1 |
| 24 | 2 |
| 57 | 3 |
| 57 | 4 |

(a) mark for each correct entry in Result – max 4 marks  
**A** blank as a repeat of the entry above  
1 mark for all the entries in Index; 5

(b) Obtain the largest value; 1

[6]

**120.** (a) (i) a common attribute(field);  
links two /related tables;  
//  
primary and foreign keys;  
create a link;  
*1 mark per point to max* 1

(ii) property / characteristic of an entity;  
one piece of information about an entity / item; 1

(b) (i) to check that data is reasonable/ appropriate;  
to check that the data entered meets requirements;  
to reduce the chance of incorrect data being entered; 1

(ii) Presence check / required field check;  
Uniqueness check;  
List membership / lookup list;  
Range check;  
Format check / picture check;  
(data)Type check;  
Existence (of data item or record) check;  
Field length check / length check;  
No of fields check;  
**R** Check digit, Verification;  
Also accept a reasonable example;  
*Any one of the above* 1

[5]

**121.** (a) (i) allocate hardware resources;  
between applications / processes requiring them;  
to ensure efficient use / no hold-ups / to maximise throughput;  
to report hardware malfunctions;  
*1 mark per point to max* 2

(ii) Processor(s) / CPU(s);  
Memory / IAS / Main memory;  
Disk (space) / backing store;   
**A** Hard disk / drive //floppy disk (drive) //secondary storage;  
I/O devices //peripherals **R** examples  
File space; **A** files **R** data  
**R** programs  
*1 mark per resource to max* 2

(b) ‘provide a virtual machine’;;  
//  
hide the complexities of the machine;  
from the user;  
//  
provide an interface;  
between the user and the computer; 2

(c) controls access by multiple users to / share network resources such as  
(shared files / applications / databases / printers.)  
/ manage more than one user using an application concurrently ;

manage printing from more than one computer on the network;  
manage security with more than one work station;  
establish / maintain communication between the work station and the server  
/ between two workstations; **R** connections  
*1 mark per point to max* 2

[8]

**122.** (a) 2  


1 mark if correct hierarchy (including rectangles or round/oval shapes) in an inheritance diagram;

**A** no shapes this year only   
1 mark for arrow in correct direction

(b) THourlyPaidEmployee = Class (Employee) 6(Public)  
 procedure CalculatePay (override)  
 procedure GetNumberOfHoursWorkedInMonth  
Private  
 hourlyrate/hourlypay/HourlyPayRate: Currency  
 NumberOfHoursWorkedInMonth : Integar/Real/Float

End

OR

public class/subclas THourlyPaidEmployee extends/inherits TEmployee; 1  
{

public void calculatePay; 1  
public void getNumberOfHoursWorkedInMonth; 1  
private; float hourlyPayRate; **1 mark for private, 1 mark for var name**  
private int numberOfHoursWorkedInMonth; 1

}

Accept “Object” instead of “Class”  
Accept Public implied  
Lose one mark if properties from parent class included  
**R** any diagrams

[8]

**123.** (a) 4



1 mark for showing 16 bits throughout

(b) (i) 4

|  |  |  |  |
| --- | --- | --- | --- |
| Symbolic Address | Hexadecimal Representation | Binary Representation | Decimal Value |
| Num2 | A802 | **1010 1000 0000 0010;** | **-2.75;;;** |

if answer wrong give:  
moving e places to right / exponent processing 2e or equivalent:1 mark  
correctly identifying negative number 1 mark  
**follow through if binary representation wrong**

(ii) To maximise precision in a given number of bits // to minimise rounding  
errors  
// to have just one representation of the decimal number // to simplify  
arithmetic operations; 1  
**A** to maximise accuracy in a given number of bits;

[9]

**124.** (a) a procedure/routine which calls itself//is defined in terms of itself; **R** re-entrant; 1

**A** function instead of procedure **R** program  
iteration Talked Out (no mark)

(b) (i) 7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **E** | **L** | **H** | **M** | **List[M]** | **Printed Output** |
| 6502 | 1 | 11 ; | 6 | 5789 ; |  |
| 6502 | 7 | 11 ; | 9 | 8407 ; |  |
| 6502 | 7 | 8 ; | 7 | 6502 ; |  |
|  |  |  |  |  | True; |

Accept True in row 3  
Marks in each row for all three/two parts correct  
Accept empty cell to mean: same as in previous row.  
Stop marking when logic goes wrong

(ii) binary search;;  
search;  
**R** any other type of search 2

[10]

**125.** (i) Name and TotalOfFines; (Accept slight mis-spelling/spaces) 1

(ii) NB Borrowers with FinesOwed > 0 required  
surnames and fines owed of borrowers who owe fines; 1

[2]

**126.** (a) NB Take note of labelling inside boxes because candidate’s positioning  
of labels may be opposite to that shown below



(i) 1  


(ii) 1  


(iii) 1  


(iv) 1  


(b) **R**. Tbl in front of table name - penalise once

(i) 1  


(ii) 3  


A.Asc or Ascending in  
correct place i.e. after  
TimeRecordedForRace  
R. Asc/Ascending in any  
other position and/or with  
other words

(iii) 3  




[11]

**127.** (a) (i) 23; 1

(b) (i) 1010 0001;; 2

one mark for correct ASCII code, one mark for odd parity bit (follow through)

(ii) 11010 00010 *OR* 01010 00011 *OR* 1

allow stop bit to be 1 or 0 but stop and start bits must be different  
follow through if (i) wrong

01000 01011 *OR* 11000 01010;

Allow both ways round for transmission

[4]

**128.** (a) network adapter/network (interface) card/Ethernet card;

A a named card type eg Token Ring Card; **R** NIC *on its own* **I** hub 1

(b) (i) A=Ring (network); B= Bus (network); 2

(ii) higher transmission rates possible with high traffic/  
performance of B degrades with heavier traffic;

**R** quicker no collisions; **A** fewer collisions;  
transmission of messages is simple (as messages travel in one  
direction only); max 1

(iii) easy/inexpensive to install;  
easy to add more stations/computers/nodes/clients without  
disrupting network;

**R** users instead of node

**R** cable breaks, **R** computer breaks max 1

(c) (i) a protocol is a set of rules; **A** set of procedures; **A** a rule; 1

***I*** *other terms unless talked out in rest of sentence*

(ii) to ensure successful communication/transmission/interaction;  
(between different computers)  
answer must imply communication/receiving data not hardware linking  
**R** *sending data only* **R** *if connection only* 1

[7]

**129.** (a)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **List** | | | | | | | | | |
| **Ptr** | **Temp** | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] |
|  |  | 43 | 25 | 37 | 81 | 18 | 70 | 64 | 96 | 52 | 4 |
| 1 | 43 | 25 | 43 |  |  |  |  |  |  |  |  |
| 2 | 43 |  | 37 | 43 |  |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 81 |  |  |  | 18 | 81 |  |  |  |  |  |
| 5 | 81 |  |  |  |  | 70 | 81 |  |  |  |  |
| 6 | 81 |  |  |  |  |  | 64 | 81 |  |  |  |
| 7 |  |  |  |  |  |  |  |  |  |  |  |
| 8 | 96 |  |  |  |  |  |  |  | 52 | 96 |  |
| 9 | 96 |  |  |  |  |  |  |  |  | 4 | 96 |
| 10 |  |  |  |  |  |  |  |  |  |  |  |

**ignore Ptr & Temp column**

1 mark for each of rows 1, 2, 4, 5, 6, 8, 9

(Final list 25, 37, 43, 18, 70, 64, 81, 52, 4, 96)

7

(b) control will pass to the instruction after Endwhile;  
/the instruction/command/statement after Endwhile will be executed;  
program will exit while-block; loop stops;  
**A** algorithim stops; **R** program stops; max 1

(c) (i) 25; 3

if part (a) not fully correct allow follow through: or lower of [1] & [2]

(ii) 81;

only allow follow through mark if the list at the end of part(a) is still a partially sorted list

(iii) 96;

must be 96 in all cases

[11]

**130.** (a) OS hides complexities of hardware from the user; 1

(b) Any three @ 1 each  
Processor(s)/cpu(s);  
Memory/IAS/Main memory;  
Disk (space)/backing store; **A** Hard disk/drive //Floppy disk (drive)//  
Secondary storage  
I/O devices//peripherals; **R** examples  
File space; **A** files **R** data  
**R** programs max 3

[4]

**131.** (a) (i) Network; 1

(ii) Interactive; 1

(b) (i) EditionId;  
Or  
Date; max 1

(ii) Date; (If EditionId used in (i))  
EditionId; (If Date used in (i)) max 1

(iii) EditionId; 1

(iv) 1 1 3

EditionId, PageNo, BlockNo;; **R** FilePathName  
Unique or equivalent;

(c) Enlarge/Stretch;  
Reduce/Shrink;  
Crop or an accurate equivalent;  
Airbrush/Rubber;  
Filter;  
Change resolution;  
Rotate;  
Change colours/greyscale;  
Distort;  
Flip;  
Zoom;  
**R** Cut out required bits, **R** Cut, Paste, **R** Adjust contrast/brightness  
**R** Moving image max 2

[10]

**132.** (a) (i) Data must be in given order  
1 pheasant 2  
2 teal 3  
3 widgeon 5

START 4 partridge 1  
5 woodpigeon 0

//



End Pointer can be blank  
1 for correct START and END pointers;  
1 for correctly numbered nodes and correct pointers  
(Need all birds);

(ii) 1 pheasant 7 2  
 2 teal 3  
 3 widgeon 5  
 4 partridge 1  
 5 woodpigeon 0  
START 6 grouse 4  
 7 snipe 2

// correctly amended diagram

1 for grouse and snipe physically at end;

1 for correct pointers (if not as ms than clear and logical);

(b) The amount of memory taken up can vary;

// The size / length of the structure / linked list can vary; 1

at run time; 1

(c) A heap / stack/ a pool of available locations;  
A pointer holds the address of the allocated block / next available location; 2

[8]

**133.** (a) (i) 8; 1

(ii) Each time a comparison is made in a binary search the number  
of items to be searched / list is halved; 1

// 137 lies between 27 and 28;

Could give (ii) even if (i) incorrect

(b) (i) 137; 1

(ii) In a linear search of 137 items, the required item might be the 137th one; 1

need a termination – must explain why 137 is the maximum

[4]

**134.** (a) (i) 1011 1101 1001 0011; 1

(ii) 1011101000 000011

-ve number; 1

exponent +3; (*explained or demonstrated*) 1

value 4 3/8; 1

Answer –4 3/8 / -4.375

1 mark for each of three points to max 3

(b) Normalisation ensures the maximum possible accuracy for Any 2 points to max 2  
a given number of bits; (*given no. of bits can be implied –  
e.g. leading zeroes can be replaced by significant digits  
at the end of the mantissa*)

Arithmetic operations simplified  
Ensures that only a single representation of a number is possible;

[6]

**135.** (a) Files are stored in separate directories / folders; 1  
**A** path / pathway

(b) disk stores a disk map to indicate free and used blocks / FAT; 2  
disk stores information such as disk volume name / label/  
capacity of disk / number of sectors;  
boot sector / messages;  
disk stores directories for disk / contains system files;

**Any 2 points @ 1 each**

(c) (i) *n.b. loading executable file* 2  
searches directory for match with given file name;  
obtains a block address / uses FAT to locate file;  
obtains size of file;  
load file into memory;  
checks file is compatible / not corrupted / no virus;  
check file status (not already open, licensed)

Any 2 @ 1 each

*Error:* no matching file / invalid file name / file corrupt / 1  
file already opened / /incompatible file type;

(ii) finds required amount of memory space / allocates memory; 3  
loads into memory / co-ordinates sharing of memory (DLLs);  
relocating loader translates addresses;  
using size of file;  
marks memory as taken / keeps track of where loaded;  
allocates base and limit register values;  
set up Page Management Table / **A** allocates segment descriptor table;  
manages virtual memory;

Any 3 @ 1 each

*Error*: insufficient memory / memory full. 1

[10]

**136.** (a) Produces re-usable code because of inheritance / encapsulation; 2  
Data is only accessible in well defined ways (because encapsulated);  
More efficient to write programs which uses pre-defined / inherited  
objects / classes;

*Storage structure of data and the code in an object may be altered  
without affecting programs that* *make use of the object;*

*Code produced contains fewer errors / more reliable;*

*Solutions are easier to understand when expressed in terms of objects;*

*Easier to enforce design consistency – Windows GUI functionality;*

*Cheaper production costs / Less maintenance effort required by  
developer since reliable ‘objects’ can be re-used / bought in;*

*New functions can be added to objects easily (because encapsulated);*

Any 2 advantages @ 1 each – must state an advantage, not make a statement.

***R*** *Object is independent.*

(b)



1 mark for correct base class and derived classes ; 1

1 for 2 correctly directed arrows. ; 1

(c) Member = **Class**  
 (Procedure) AddNewMembers; }  
 (Procedure) AmendMembers; } ;  
 (Procedure)ShowMembers; }  
 **Private** ;  
 MembershipNo : Integer  
 Name : String;  
 Address : String; ;;  
 **End;**  
*Exact syntax not required, but must be in style of .  
3 procedures* 1  
*Private* 1  
*All 3 field (property) names* 1  
*3 reasonable data types* 1

[8]

**137.** (a) E-mail may pass through many computers/servers if it travels over  
a network, each computer can make a copy/can be accessed;  
When a message arrives at its destination, it waits until the  
intended recipient picks it up. During this time the message  
is vulnerable to being read or copied by the computer’s operator;  
Electronic eavesdropping of telephone wires and local area  
networks is possible;  
With e-mail alterations leave no trace(no physical damage)  
whereas with paper alterations leave a physical mark; max 1

(b) (i) E-mail encrypted using public key;  
Recipient’s private key used to decrypt e-mail; 2

(ii) E-mail encrypted by sender using private key;  
Recipient decrypts e-mail using sender’s public key; 2

[5]

**138.** (a)



(NB don’t allow relationship between Ward and PatientMedical Condition) max 3

(b) **For each extra attribute lose one mark**

(i) Ward(WardName, NurseInCharge, NoOfBeds) **;**  
**A** NumberOfBeds, NameOfNurseInCharge, NurseInChargeName  
**R** WardId, Name, NurseName. NameOfNurse, BedNo, BedNumber,  
NumOfBeds 1

(ii)   
Patient(PatientNo, Surname, Forename, Address, DOB, Gender,  
*WardName*)  
**A** PatientId, PatientNumber, PatientSurname, PatientForename,  
PatientAddress, DateOfBirth, PatientDateOfBirth, PatientGender,  
Sex, PatientSex 2

(iii) MedicalCondition(MedicalConditionNo,  
Name,RecommendedStandardTreatment)  
**A** MedicalConditionId, MedicalConditionNumber,  
MedicalConditionName, **;**  
ConditionName, StandardTreatment,  
Treatment, RecommendedTreatment  
**R** ConditionNumber, ConditionID 1

(iv) **; ;**  
PatientMedicalCondition(*PatientNo*. *MedicalConditionNo*)  
**A Attributes rejected in (ii) and (iii) for PatientNo and  
MedicalCondition No  
R If attributes used are not consistent with (ii) and (iii)** 2

(c) **Accept tbl in front of table name** **;**

Select Patient.Forename, Patient.Surname,  
PatientMedicalCondition.MedicalConditionNo  
 From Patient, PatientMedicalCondition **;**   
 Where Patient.WardName =‘Victoria’ **;**  
 And Patient.PatientNo = PatientMedicalCondition.PatientNo **;**  
A. Forename, Surname, MedicalConditionNo, WardName max 3

[12]

**139.** (a)

 2

(i) First mark: collisions; **R** clashes  
Second mark: Frame/Packet//Description of how collisions occur,  
e.g. two stations sending at same time/stations have to resend;  
**R** Accessing file server at same time 2

(ii) 1 mark for drawing two segments connected by a bridge. 2  
1mark for a second segment consisting of hub and workstations  
D, E, F and File Server 2.



(c) (i) First mark is for switched Ethernet explanation. Second mark is for hubbased Ethernet explanation.  
Switched Ethernet allows a computer such as workstation A to send a  
packet to workstation D, for example, at the same time as another, e.g. B,  
is sending to workstation F//a sending workstation’s packets are sent to  
only one workstation//Switched Ethernet segments network into smaller  
segments;

If this is attempted in a hub-based network a collision will occur/only two  
workstations are permitted to communicate at the same time//a sending  
workstation’s packets are broadcast to all workstations//hub-based network  
is just one segment; 2

(ii) **NB** Emphasis is on transmission not performance of file server  
Transmission or equivalent speed is higher;  
Transmission or equivalent speed is faster;  
Transmission or equivalent speed is greater;  
Transmission or equivalent speed is quicker;  
No collisions;  
**A** Network is faster max 1

[9]

**140.** (a) nodes/systems/networks/machines/computers connected/ linked/  
communicating;

on different sites; over large geographical area/by satellite/telephone line/; 2

**R** different buildings

(b) (i) modem/ISDN adapter/ADSL adapter; **R**  network card 1

(ii) Browser software; http communication software; Telnet; FTP;   
Gopher;SSH;

**R** internet server **R** dial-up networking software  
 1

(c) Bits are sent one after another/bits are sent one at a time/ bit by bit /bits   
sent singly / bits along a single wire / line;

**R** data 1

(d) (i) one baud is the number signal/voltage changes per second;

**A** rate at which signals are sent; **A** rate at which voltage changes;

(ii) number of bits per second / bits per unit of time;  
bitrate = baudrate \* number of bits (per signal change); 2

**R** the rate at which bits are sent *(question paraphrased)*

[7]

**141.** (a) Any two at two each; If entrance method doesn’t match exit method  
mark one wrong and the other correct  
**R.** Voice **R.** Written to ticket  
Computer system/Printer prints number on ticket at entrance;  
Driver types number into system using a keypad at exit barrier;

Computer system encodes number on a magnetic stripe on ticket  
at entrance;  
**R.** Magnetic card  
Ticket number read by a magnetic stripe reader at exit//inserted  
into a magnetic stripe reader at exit; **A** magnetic strip/stripe scanner

Computer system/Printer prints number printed on ticket at entrance;  
Number read by an optical character reader/OCR at exit//ticket inserted  
into an optical character reader at exit;

Computer system/Printer prints number in barcode form on ticket at  
entrance;  
Number read by barcode reader at exit//ticket inserted into barcode  
reader at exit;

Computer system/Printer at entrance punches holes on ticket which  
are a coded form of number//Kimbal tag produced at entrance which  
encodes number;  
Number read by sensor (mechanical or optical) at exit//ticket inserted  
into sensor at exit//Number read by Kimball tag reader at exit;

Computer system/printer prints number using magnetic ink;  
At exit MICRreader reads number;

Computer system/printer prints marks (encoding number) on ticket;  
At exit, OMRdevice is used; 4

(b) **R.** any other data types. Mark is for field name + correct data type.

NB synonyms for RandomNumber must include Number, e.g. IDNo,   
TicketNo, Number. **A.** RandomInteger, **R** e.g. Vehicle ID **A.** VehicleIDNo

A. DateTicketWasIssued

Record

RandomNo : Integer; **R.** anything else 1

CurrentDate :

String/Date/DateTime/TDateTime/TDate; 1

ArrivalTime :

String/Integer/Time/DateTime/TDateTime/TTime; 1

LengthOfTime/LengthOfStay/TimeStayed : Integer;

**R.** anything else 1

Cost/AmountToPay : Integer/BCD; 1

End;

**A.** Alphanumeric for String

**R.** Text **R.**LeavingTime **R.** Binary,Byte,LongInteger

**R.** Date for FieldName

**R.** Date/Time but don’t penalise twice

[9]

**142.** (a) **A** card that is embedded with a microprocessor/processor/cpu and memory chip;  
**A** card that is embedded with a memory chip with non-programmable logic;  
**A** card that is embedded with a memory chip and logic circuits ;  
**R.** Card that remembers something 1

(b) CallId;  
SimCardNo, Date, Time; 1

(c) (i) An attribute/field in one relation/table that is the  
primary key in another relation/table; 1

(ii) SimCardNo 1

(d) (i) Changes/Updates are made in a timely manner ;  
Changes are made immediately/instantaneously/in an instant ;  
Changes are made as they happen;   
**R.** updated continuously 1

(ii) Processing which is not carried out until all the data have been   
entered into system;  
Processing is applied to all the transactions in one go/at one time;  
Processing that proceeds without human interaction;  
**R.** Collected – must be entered  
**R.** Processed in batches 1

(iii) Network needs to know the current base station of each mobile phone;  
Network needs to know the current location of each mobile phone;  
To keep location information current;  
Because user may change location; 1

(e) (i) To speed up searching/queries;  
To speed up access;  
**R.** To speed up processing 1

(ii) SimCardNo 1

(f) (i) 2 1

(ii) **A.** or ? or \* or × in SimCardNo and ServiceType fields  
Column headings must be accurate  
**A.** <= 28/02/2002

|  |  |  |
| --- | --- | --- |
| **SimCardNo** | **ServiceType** | **ActivationDate** |
|  |  | < 01/03/2002 |

; ; ; 3

(g) (i) What: Calculated digit// digit calculated from other digits in  
 MobilePhoneSerialNo; 1

(ii) Purpose: To check MobilePhoneSerialNo not corrupted;  
 To check integrity in MobilePhoneSerialNo;  
 To detect error in MobilePhoneSerialNo;  
 To check MobilePhoneSerialNo has been recorded/input   
 correctly;

**R.** To make sure(ensure) data/MobilePhoneSerialNo  
 is not corrupted/erroneous  
**R.** To check number is valid/correct **R.** To check for correctness 1

[15]

**143.** Queue is FIFO ; 1  
Stack is LIFO; 1  
*Given that:*Process of taking elements from queue to stack 1  
Process of popping stack 1

[4]

**144.** TForm1 = Class(TForm) 1  
 Button1:Tbutton; 1  
 Button2:Tbutton; 1

End

NB 1 mark for BOTH buttons

*//*

Class Tform1 extends Tform  
{Tbutton Button1;  
Tbutton Button 2;  
}

Must look like code.  
1 mark for connecting TForm1 to Tform **A** inherits, :  
1 mark for defining both buttons as type Tbutton **A** As  
1 mark for {} or End

[3]

**145.** (a) (i) positive 1

(ii) <2-2 1

(b) Correct answer 194.5 or 194 ½ 2  
working 1 3

If wrong answer, method marks as follows:  
 exponent 28 clearly identified 1  
 application of shift / \*28 from correct start point 1  
 correct interpretation of bits 1

**Basically here, if it is a little inaccurate, give 2 marks,  
if quite inaccurate but slightly correct give 1.** Max 2

(c) (i) Processing fixed point numbers is quicker than floating point /  
less processing required;  
More accurate/greater precision; 1

(ii) Where the possible range of numbers to be stored is limited / small;  
Where number is of a set format / processing integers /   
Working with currency;  
Where maximum precision is required 1 2

[7]

**146.** (a) Head (Tail ( Days)) = Mon **R** [Mon], MON 1

Tail([Head(Days)]) = [ ] 1

Empty(Tail(Tail(Tail(Days))))=False 1 3

(b) Elements in a list can only be accessed sequentially;  
 elements in an array can be accessed directly;  
 using the subscript;  
*Any 2 points to max* 2

[5]

**147.** (a) root, 1  
branch 1  
leaf node 1  
*must circle!*



(b) left sub-tree 1



right sub-tree 1



(c) W-X / Y+Z 3  
 1 1 1

**A** column vector  
*Spurious punctuation* 1

[8]

**148.** LAN;  
Justification:  
 Computers in health centre are in close proximity to each   
 other/geographically close/in same building/on same site;  
 **R.** Computers within health centre on its own 2

[2]

**149.** (a) (i) 1



(ii)



**I.** other entities 1

(b) (i) Select Book.Title **A** Title   
From Book;  
Where Book.ISBN = “1-57820-082-2”; **A** ISBN = “1-57820-082-2”;  
Any extra attributes lose mark where extra attributes used  
**R.** 1-57820-082-2 Need quotes  
**A.** ‘1-57820-082-2’  
**R.** TblBook – penalise once  
**R.** Title.Book, wrong order 2

(ii)

Don’t need Book in Select

Select Book.AuthorName, Book.ISBN ;

**A. BookCopy.ISBN in place of Book.ISBN**

From Book, BookCopy ;

Where (Book.ISBN = BookCopy.ISBN) ;

And (BookCopy.AccessionNumber = 1234) ;

**A. AccessionNumber in place of BookCopy.AccessionNumber**

**R.** quotes on 1234  
Any extra attributes lose mark where extra attributes used  
Brackets non-essential. May see conditions interchanged, this is Ok

**A. in for =**  


**Penalise TblBook/TblBookCopy once**

(c) Mail-merge//Mail-merging 1

[9]

**150.** (a) (i) Too much traffic//Congestion//slow to respond//too many (packet/frame) collisions; (Candidate may answer reduces traffic, etc. This is OK)  
**A.** Performance degrades 1

(ii) Bridge “learns” which desktop PCs connected to each port//bridge stores  
Ethernet addresses of desktop PCs connected to port **A** and port B;  
Bridge blocks packets destined for a desktop PC on same segment from   
being passed to other segment// Bridge only passes packets destined for   
a desktop PC on other segment;Packets between machines on same   
segment are ignored by bridge/blocked by bridge;

Packets between machines(using machine identifiers is OK, e.g. PC1)   
on different segments transferred by bridge;

**A.** Messages for packets 2

(iii)



**R.** Missing bridge correct hubs – penalise once  
No hubs – scores zero 2

(iv) **A** user logged in at one peer computer is able to use resources on   
any other peer computer;  
In a peer-to-peer network, there are no dedicated servers;  
In a peer-to-peer network all computers are equal/have equal status;  
Each computer functions as both a client and a server;  
User at each computer acts as both a user and an administrator   
(determining what data, disk space and peripherals on their computer   
get shared on the network)//User at each controls what is shared   
with other computers;  
**A** Network with no central control;

**R.** Each computer is directly connected to each other and so can  
send to each other without a server

**R.** All computers have same rights 1

(b) (i) To provide access/interface to the Internet/World Wide Web  
(to individuals/organisations/businesses);  
To act as hosts for Web pages (that individuals/organisations/  
businesses wish to publish on the Internet);  
To provide electronic mail boxes;  
To provide services related to Internet access; 1

(ii) **A** router is a device that receives datagrams or packets from one   
computer and uses the IP addresses that they contain to pass  
on these packets, correctly formatted, to another computer;  
Device which uses IP addresses to route packets; 1

(iii) 192.168.1.1; 1

[9]

**151.** (a) several bits are transmitted simultaneously/at the same time;  
down several wires;

**A** several bits of data; **R** data

**R** down 2 wires **A** diagram **A** a byte/word at a time; 1

(b) exchange of signals between devices/devices communicating  
with each other; to establish their readiness to send or receive  
data/a method of ensuring that both the sender and receiver are  
ready before transmission begins; 2

[3]

**152.** (a) (i) share printer; share database; central backup possible;  
data consistency; electronic messaging/communication;  
share data/information/files/software; access files from  
any computer; easier to upgrade software; max 2

(ii) network adapter/network card; **R** modem 1

(b) (i) more secure;  
if a cable breaks only one node is out of action; **R** computer  
instead of cable  
performance does not degrade with increase in traffic;  
easier to find cable fault; max 1

(ii) cheaper to set up; less cable needed; max 1

(c) (i) the name of an internet site/user friendly id of an internet site;  
R address 1

(ii) (www.)companyname.co.uk *(any valid domain name)  
does not need www, could be ftp or wap also* 1

(d) a communication system providing similar services to the Internet;  
solely within a particular company or organisation/company wide;  
an internal; internet; max 2

[9]

**153.** (a)



A mirror image (this time) 4

(b) ‘T’ 4; ‘U’;

‘T’ 5; ‘S’;

‘T’ 7; ‘T’; 6

no penalty if candidate gets ‘item’ wrong  
ignore ‘item’ column.

[10]

**154.** (a) Real-time processing:

Inputs processed in a timely manner(immediately) and system responds  
in a timely manner (immediately);  
**R** Examples 1

(b) Real-time; 1

[2]

**155.** (a) Name: Copyright/Copyright, Designs and Patents Act/Right to copy;  
Way: Any one for one mark  
 Copying music without a licence/Copying music without permission  
 Copying music without authority/Copying music without consent/  
 Copying software without a licence/Copying software without permission/  
 Copying software without authority/ Copying software without consent;  
 **A** Obtaining without permission 2

(b) (i) CD-ROM;  
DVD-ROM;  
CD-R;  
DVD-R;  
**R** DVD, CD, CD-RW, DVD-RW 1

(ii) Any two @ one each  
CD drive or DVD drive or DVD player;  
Speaker(s)/Headphones;  
Sound card;  
Graphics/Video card;  
Video Projector; max 2

(c) Data Protection Act;  
Integrity: Personal data must be up-to-date (accurate). (Not “used  
only for correct, declared purpose”);  
**A** Personal data must be correct/true  
Security: Personal data must be kept secure(safe)/Prevent  
unauthorised access/ prevent unauthorised alteration/ prevent  
unauthorised deletion/prevent unauthorised disclosure/ prevent hacking; 3

[8]

**156.** (a) Magnetic Strip(e) Reader (Not swipe card reader); 1

(b) What: Extra/last digit(**A** number) in borrower code;  
Calculated digit;  
Why: To detect if data/code has been corrupted;  
To check that data/code is valid;  
To ensure integrity of data/code;  
**A** To check that number is valid  
**A** To check that data/code is still correct after transmission  
**R** To check that data is plausible 2

(c) Reason: magnetic stripe reader may not be able to read borrower code;  
Because magnetic stripe is damaged;  
Can phone in code;  
Code needs to be entered through a keyboard; 1

(d) Bar code reader/Bar code scanner;  
**R** Scanner  
**R** Light pen 1

(e) (i) Unique field of a record/field used to identify record; 1

(ii) BookCode; 1

(iii) Serial; 1

(f) (i) BookCode; 1

(ii) Reason: Any one for 1 mark  
So one pass is possible;  
Reduce time taken to update Books file;  
Saves time;

Order: Same as Books file/ordered on BookCode; 2

(g) **NB** steps must be clear. **R** a narrative in which steps  
 not made explicit  
 = zero marks

Alternatives:  
Compare Current Date with DateBookToBeReturnedBy field;  
If = or >= or >; If (LoansStatus = OnLoan);  
And TodaysDate >|>=|= ;  
 DateBookToBeReturnedBy

Steps:  
Open Books file;  
(Read or idea of going to) each record in turn/  
(Read or idea of going to) next record;  
Until EOF;  
If LoanStatus = OnLoan;  
 Then  
 Compare DateBookToBeReturnedBy field with current date;  
 If = (allow <= and <) ;  
 Then Write details to OverDueBooksFile; 4

Data:  
Any three @ one each (No T.O.)  
BookCode;  
BorrowerCode;  
DateBookToBeReturnedBy;  
ISBN;  
Title:  
Author; 3

**R**. any others Candidate must state these accurately

[18]

**157.** (a) Collection of tables/a database in which relationships are modelled  
by shared(common) attributes;  
**A**. Set of tables  
**A**. Two or more tables  
**R** Two tables  
**R** Entities 1

(b) (i) Primary key: CompetitorId;  
Justification: Unique; 2

(ii) RacingDivisionId 1

(c) (i) Foreign key = An attribute/field(Not key) in one table; which is  
 the primary key in another table/identifies  
 a row in another table;  
 **R** record or file  
 **R** Foreign key links two or more tables 2

(ii) RacingDivisionId; 1

(d) (i) To speed up searching/To make access faster;  
 **R** easier  
 **A** Save time; 1

(ii) RacingDivisionId; 1

(e) Three correct columns gets 1 mark 2  
All four correct gets 2 marks

**A** Cat1 in place of =Cat1

|  |  |  |  |
| --- | --- | --- | --- |
| CompetitorId | Name | PointsAccumulated | RacingDivisionId |
|  |  | > 300; | = Cat1; |

[11]

**158.** (a) Diagram



(b)

1 for position, 1 for correct arrows. 2

Circles not necessary

OK if completely upside down.

e.g. number of legs, colour, web type; 1

*Property Method*

Spin web/eat; 1

***R*** *instance of property, e.g. 8 legs*

*Does not have to be biologically correct but sensible!*

[4]

**159.** (a) *Client –server system*

A server provides services required by client workstations/applications; 1

Such as file storage/communications/web access; *(dependant on first point)* 1

OR

Server distributes data to client system requesting it; 1  
Clients process data;. 1

(b) *3 benefits*

Client workstations can have lower processing speeds/hard disc  
capacity – and so cheaper;

A print server will manage the printing on behalf of the clients;  
All client workstations can share 1 copy of an application;  
All client workstations can share data/backups easier;  
Enables greater security such as access rights/control over  
Internet access/firewall/one Internet access point;  
Upgrades easily managed because only one copy of software;  
Licensing managed because use can be monitored. 3

[5]

**160.** (a) *Mantissa*

Significant digits/precision/answer by example; 1

*Exponent*

Power of 2 by which mantissa is to be multiplied to get original  
value/How many places the point has to move/answer by example;  
***R*** *decimal point* 1

(b) (i) Mantissa  Mantissa identified

0110101100 000011 1

(ii) Msb/leftmost bit/starts with determines sign of number; 1

0 so +ve &/or 1 if –ve. 1

(c) Convert –3 into 2’s complement; 0000 0011

Add to 2’s complement value of +5; 1111 1101;

*If 3-5 calculated correctly give 1* 0000 0101*+  
method mark* 000 0010; 2

(d) Increased range that can be stored in a given number of bits; 1

[8]

**161.** (a) *Tail(Ports)* [Barcelona, Athens, Alexandria, Tunis, 1  
 Lisbon] *square brackets needed*

*Head(Tail(Tail(Ports)))* Athens 2

[Athens] 1

*Empty(T(T(T(T(T(T(Ports)))))))* True 2

True [ ] 1

[True] 0

(b) *Recursively defined*

A definition which is defined in terms of itself/contains within  
its body a reference to itself/calls itself ;

**A** re-entrant; *(In specimen papers 2001/2, but refers  
specifically to a procedure)* 1

(c) *Stack necessary*

The state of the machine/contents of appropriate registers/  
return address // saved each time the procedure is called; 1

and retrieved in reverse order from the stack as control is  
progressively returned; 1

OR

different value of parameters /local variables; 1

must be available each time procedure is called; 1

OR

P must be re-entrant *(In specimen papers 2001/2 )* 2

(d) Lisbon first; 1

Southampton last; 1

All 6 in order 1

No punctuation; 1

i.e. Lisbon Tunis Alexandria Athens Barcelona Southampton; 4

(e)



2

[14]

**162.** (a) bus;  
**R** line 1

(b) (i) *connections correctly done as a star; allow a hub drawn in  
no arrows required.* **R** *diagram of a mesh network* 1

(ii) (*Advantage*)  (*Reason*:)

if one cable fails it affects only one computer; as each computer is directly connected to central computer;

**R** computer fails

simple to isolate faults; **A** each computer has its own line;

different computers can transmit at different “  
speeds;

system more secure; as messages are sent directly  
 to central computer;

network does not degrade when highly “  
loaded;

**R** collision free *unless explained*

**R** easy to add / remove computers **R** reliability **R** faster max 2

[4]

**163.** (a)

  
*Ignore other cells*

(b) convert an integer into its binary equivalent; 1

[7]

**164.** (a) bits transferred simultaneously / concurrently; **R** data **R** bytes  
bits sent down many wires at the same time; **A** bits of data max 1

**A** *a clear diagram*;

(b) (i) data get skewed; timing of bits becomes different / out of line;  
**A** over longer distances the data may not be correct;  
**A** too expensive because of amount of wires/cables/lines;  
**R** signal decays **R** corrupted data max 1

(ii) use serial transmission; 1

[3]

**165.** (a) (parity bit is adjusted to make) number of 1’s / on/off bits even;

parity bit is regenerated/checked by receiver;  
check parity bit after transmission;  
if number of 1-bits is now odd, there was an error in transmission; max 3

(b) the greater the bandwidth the greater the rate at which data can be sent;  
bit rate increases as bandwidth increases;  
bit rate (directly) proportional to bandwidth; max 1

[4]

**166.** Primary key = ProductId;  
Justification: Other fields would not be unique/ ProductId is likely to be unique; 2

[2]

**167.** Treat candidate’s responses to name and reason independently, i.e. name gets mark  
even if reason is wrong and vice versa.

(a) Name: Network;  
A. Network qualified by interactive, multi-access, multi-user  
R. Peer-to-Peer network, LAN, network topologies  
Reason: File requests must be re-directed to other computers on network  
R. file sharing, data sharing, printer sharing, communication between  
computers, security checking 2

(b) Name: Real-time Or Real-time process control, Real-time control;  
Reason: System must respond in a timely manner to variations  
in flow-rate Or instantaneous response required Or must react quickly; 2

[4]

**168.** (a) Collection of tables Or a database in which relationships are modelled by  
shared(common) attributes;  
R. Two tables  
A. Two or more tables  
A. Relations in place of tables  
A. Fields for attributes  
R. Entities for tables 1

(b) Primary key = MagazineEditionId;

Justification = Unique; 2

(c) R. Record

(i) Foreign key = An attribute(field) in one table which is  
 the primary key;  
 in another table;

A. a linking field; 2

(ii) MagazineEditionId; 1

(d) (i) To speed up searching;  
To speed up access;  
R. To sort 1

(ii) AuthorName; 1

(e) (i) 2; 1

(ii) A. < 2000, =< 1999 for Year. A. =Management, “Management”  
for ArticleType. A.  in Authorname and ArticleTitle boxes.  
 1 1 1 1

|  |  |  |  |
| --- | --- | --- | --- |
| AuthorName | ArticleTitle | ArticleType | Year |
|  |  | Management | <=1999 |

<= must be to left of 1999  
Attribute names must be fairly accurate (minor misspellings and spaces allowed  
but REJECT plurals)  
A. LT 2000, LTE 1999, LE 1999

A. 

in place of Year column ;;;;

4

[13]

**169.** (a) +3x; 1

(b) 3+x; 1

(c) 3x+; 1

[3]

**170.** (a) 11, 17, 9,21,15,23; 2

(2 if all right, 1 if 4 of 6)  
If > misinterpreted, follow through for 1 mark

(b) A bubble sort; 1

(c) To detect when all the numbers have been sorted  
Efficiency (to stop procedure repeating unnecessarily);  
**R** to detect when numbers have switched 1

[4]

**171.** (a) 2



Dean accessed first  
Pointer / arrow

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Dean | Claire | Bob | Anne |

End pointer **** Start pointer ****

Anne accessed first;  
Named pointers correct;

(b) 2



correct item replaced;

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Eden | Dean | Claire | Bob |  |

Eden Start pointer ****  
pointer  
****

correct item retrieval & input;  
correct moving of pointers

(c) In a linear queue data is static, so queue ‘moves’ through storage/  
In a FIFO structure storage locations are only used once; 1

In a circular queue, the locations will be re-used; 1

Thus a circular queue has a more efficient use of memory; 1

1 mark for each of 2 points

[9]

**172.** (a) (i) *A class* 1

A grouping of data structures and behaviours /  
methods / procedures / functions;  
A set of objects / object type which share a  
common data structure and common behaviour /  
methods / procedures / functions;

Need both structure and behaviour  
**A** variables, attributes

(ii) *Inheritance*Relationship among classes wherein one class shares  
the data structure and behaviour/methods / procedures /  
functions / actions of another class

OR when a class has the same characteristics as its parent class  
**A** attributes / features / properties 1

(b) 3



1 mark for correct base class  
1 mark for two correct derived classes  
1 mark for **2** correctly directed arrows

(c) *Advantages* 3

Produces re-usable components (you do not have to know how they  
are written);  
**A** code  
Data is protected – only accessible in well defined ways;  
Easier to write programs which use pre-defined objects / classes;  
Storage structures of data of an object may be altered without affecting  
programs that make use of the object;  
Code of an object may be altered without affecting programs that make  
use of the object;  
Solutions that use objects tend to contain fewer errors / more reliable;  
Solutions are easier to understand when expressed in terms of objects;  
Easier to enforce design consistency;  
Cheaper production costs when software can be re=used;  
Less maintenance effort required by developer since reliable ‘objects’  
can be bought in;  
New functions / features can be added to objects / classes easily (inheritance);

1 mark for each of 3 points to max;

[8]

**173.** (a) (i) **Baseband:** Single /data signal sent at a time Or single  
 message/packet/frame sent at a time Or uses single channel Or one  
 transmission at a time  
 **A.** Single stream of data;

over full bandwidth (of the cable) Or occupying full bandwidth  
(of the cable)  
Or signal uses all available frequencies;

(ignore any additional references which are bits, 0/1 in  
any part of the above)  
**R.** Single bits sent at a time  
**R.** Only works over short distances

(ii) **Broadband:**  
Several /data signals sent simultaneously Or several messages/  
packets/frames simultaneously Or more than one signal occupies  
bandwidth ;  
Each at a different frequency Or in a different channel  
Or in a different time slot;

Or

Multiple channels used;  
Each at a different frequency Or in a different time slot;

Or signal(or equivalent) uses only one frequency Or signal  
(or equivalent) uses only part of bandwidth;;

**R**. fast connection  
**R**. Video, sound and text .....  
**R**. ADSL, cable examples, etc 4

(b) (i) **Two reasons:**

Wide area networks expensive to install;  
Wide area networks expensive to maintain;  
Wide area networks involve long distances;  
Can allow multiple data streams to keep down costs  
Or can share transmission medium to keep costs down;  
Many channels needed to cope with high volume of traffic  
Or enables more users to use network without experiencing  
congestion;  
**R**. Faster  
**R**. can work over longer distances  
**R**. More than one user will want to use it simultaneously  
**R.** Cheaper, more efficient max 2

(ii) First mark: (More packet) collisions take place;  
 Stations attempting to send at the same time;  
 Each station broadcasts to every other one;  
 Some stations may be attempting to broadcast  
 at the same time;  
Second mark: Packets need to be sent again;  
 Station has to retransmit (after a random delay); max 2

(iii) First mark: Exclusive bus connection (made temporarily  
 between sender and receiver)  
 Or data transfers take place in turns  
 Or switch connects just sender and receiver  
 Or collision domain limited to two stations  
 Or switch splits bus LAN into several  
 smaller segments  
 Or switch allocates a time slot to each transmission  
 Or each host/computer/station/workstation/  
 node has its own link on which one packet  
 at most can travel  
 Or switch allows a dedicated connection/pathway  
 to be set up when a computer wishes to send  
 information to another  
 Or switch separates work stations (in different  
 segments)and only passes packets between  
 segments when necessary  
 Or switch (ports) act as bridges which  
 segment network;

Second mark: therefore collisions cannot occur  
 (between two stations)  
 Or collisions reduced; 2

[10]

**174.** (a) 3



If candidates gives more than required mark all to a max of three

(b) NB Order of attributes is immaterial

(i) *1 mark for primary key 1 mark for other attributes unless additional attributes*

**A**. Quantity, StockLevel, Stock, AmountInStock, Amount,  
NumberInStock, Qty\_Stock, Qty  
**A**. Description

Product (ProductId, ProductDescription, QuantityInStock) 2

(ii) *1 mark for primary key 1 mark for other attributes  
(unless extra other attributes)*

**A**. Name, Address, (Customer)TelephoneNo, (Customer)  
TelephoneNumber, TelNo, (Customer)TelNumber,  
**R**. Phone, Telephone, **A**. Multiple lines for address  
including postcode, etc, **A**. Breakdown of name into  
forename, surname.

Customer (CustomerId, CustomerName,  
CustomerAddress, CustomerTelNo);

2

(iii) *1 mark for primary key 1 mark for foreign key  
CustomerId 1 mark for other attributes unless extra other attributes*

Order (ABCOrderNo, CustomerId, CustomerOrderNo,  
OrderHasBeenDespatched)

**A**. Despatched, OrderDespatched, OrderStatus 3

(iv) *1 mark for primary key 1 mark for ABCOrderNo, LineNo,  
1 mark for foreign key ProductId, 1 mark for QuantityOrdered,  
unless additional attributes*

**A**. OrderLineNo, OrderLineNumber LineNumber, Line  
**A**. Quantity, Amount, Qty, Number

OrderLine (ABCOrderNo,LineNo, ProductId, QuantityOrdered) 4

(c) Attributes must correspond with table  
attributes given in part (b)

**A**. Yes, ‘Yes’, “Yes”, Y, ‘Y’, “Y”,  
Despatched, ‘Despatched’, “Despatched” in place of True 1

Select CustomerName  
(Score zero for extra attributes) 1

From Order, Customer  
(Each extra table cancels one of these marks) 1 + 1

Where Customer.CustomerId = Order.CustomerId 1  
And Order.OrderHasBeenDespatched = True 1

Order By ABCOrderNo 1

Mark first Select statement, but give credit for Order By ABCOrderNo.  
Associate And with one of the conditions.  
OK for parts of statement to be on same line, e.g. Select CustomerName  
From Order, Customer  
**A.** Customer.CustomerName  
**A.** Order By ABCOrderNo ASC  
**A.** Order By Order.ABCOrderNo  
**A.** OrderBy for Order By  
**A.** the use of aliases, e.g. Select D1.CustomerName  
 From Customer D1, Order D2  
 Etc.  
**A.** “Customer.Db” Or Customer.Db , “Order.Db” Or Order.Db  
**A.** OrderHasBeenDespatched = True  
**A.** Order By ABCOrderNo Ascending  
**A.** From tbl Customer, tbl Order 6

[20]

**175.** (a) Correctly placed labels: main memory (1);

keyboard & keyboard controller (2,5*);*disk controller & HD drive (6,4);  
monitor & monitor controller (7,3); 4



*(allow names instead of numbers)*

(b) Machine code instructions/program stored in main  
memory/RAM/IAS;  
fetched and executed; *(concept)*Can be replaced by another program any time;  
**R** cache Max 2

(c) (i) bits are sent one after another / bits sent one at a time / bits sent  
singly / along a single wire/line;  
**R** data */* character 1

(ii) bits transferred simultaneously/concurrently / bits sent down  
many wires at the same time;  
**A** diagram; **R** data / character 1

(d) (i) Between devices in close proximity / communication within  
computer / communication over short distances; 1

(ii) distance: parallel transmission only operates over short distances;  
speed: parallel transfer faster than serial; Max 1

(e) start bit marks beginning of character to be transmitted /  
alerts/synchronises receiving device; 1

stop bit(s) marks end of character to be transmitted */* gives time  
for receiving device to recover;  
frames the character; 1

[12]

**176.** (a) Computers/devices connected together by cables;  
In a small (geographical) area / on one site;  
using a recognised local area protocol eg Ethernet/Token Ring;  
**R** users connected 2

(b) (i) Bus/ Ethernet; 1

(ii) easy/inexpensive to install; easy to add/remove more nodes;  
**R** general network advantages **R** less cable **R** node failure Max 1

(iii) *if* cable fails, whole network goes down; network performance  
degrades under load; cable failure difficult to isolate;  
lower security; max 1

(c) (i) dedicated link; fixed rental independent of usage;  
constant/permanent connection/ fixed line;  
**R** private line **R** direct line Max 1

(ii) only connected while in use; pay for time connected; re-connect  
to go on-line;  
**R** public line / shared line Max 1

(d) used most of the time/a lot of traffic; need fast access; always  
available;  
**R** more reliable max 1

(e) if used only occasionally; cheaper to set up; access easier to  
control / more secure; **R** only pay for what they use max 1

[9]

**177.** (a) Interactive operating system: Any one point for one mark  
User and computer in two way communication.  
Processing carried out on data or command executed as users  
enter the data/command so that results of processing are available  
immediately to users.  
Communicating directly with program as it is running. max 1

(b) Real time 1

[2]

**178.** (a) Any 2 points @ 1 each  
NB do not accept allows more data on disk or faster access to data.  
Each directory of a manageable size/easier to maintain.  
Allows increased protection by restricting directories to certain  
users/improved security.  
Allows identical program names to be stored in different directories.  
Allows users their own directories.  
Allows special directories.  
Allows directories containing files of similar type.  
Reduces the risk of accidentally erasing other peoples’ work.  
Allows the system manager to monitor usage.  
Makes selective backup easier.  
Easier to locate files/faster to locate files.  
Allows more files on disk  
(NB easier to organise files is insufficient on its own, candidate needs  
to say something specific to get a mark) max 2

(b) Any 2 points @ 1 each  
NB on its own, the right to PROTECT a file is worth ONE mark,  
zero otherwise.  
The right to

set file status to

read only  
read/write  
execute only  
delete authority  
write only (update only)  
hidden  
set shareabilty of file  
alter/create/specify file rights max 2

[4]

**179.** (a) Unauthorised access to computer material (allow an answer which  
implies this, e.g. illegal use of a userid) 1

Unauthorised modification of computer material (allow an answer  
which implies this, e.g. change data without authorisation) 1

(b) Any three points at one each  
Computer keyboard lock  
Closed circuit television cameras  
System should enforce a choice of password that is hard to guess,  
e.g. at least six characters long, not a word in a dictionary  
System should be aware of repeated unsuccessful attempts and  
disable terminal after three wrong passwords have been entered.  
Network manager should be alerted by a message at the server if  
a number of wrong passwords have been entered in a short time  
A network access log should be kept  
Additional passwords should be required to access/alter important files  
Fingerprint/retina scan  
Swipe card  
Encrypt files  
Set files to read only Max 3

[5]

**180.** (a) Optical Mark Recognition/Reading. (Not Optical mark reader) 1

(b) Extra digit added to the transaction code 1

To detect if data has been corrupted 1

(c) (i) Unique field of a record/filed used to identify record 1

(ii) Transaction code 1

(iii) Not indexed sequential  
Serial or Sequential 1

because all the records have to be examined 1

Or

Direct access based on a hash code of the chosen numbers 1

Only a few records will need to be checked (when collisions  
occurred) 1

max 2

(iv) Random or direct access 1

Record can be located by simple transformation of transaction code  
/hashing technique used/algorithm used to store and retrieve records 1

Indexed sequential with transaction code as key field 1

Rapid access via the index is possible to find the necessary record 1

max 2

(d) Any four points at one each  
Ticket scanned/ Read ticket  
Check digit used to check accuracy of scanning Ticket validated,

(e.g. not out-of-date, draw not yet made)

Operator informed if ticket does not scan/is invalid  
Transaction code sent to central computer  
Correct file selected  
Ticket’s record found/Look up ticket’s record/Look up record with given  
transaction code  
Get draw date from transaction record  
Get numbers from system (for the correct draw date)  
Ticket numbers checked against draw  
If a winning ticket prize money determined  
Result sent to point of sale machine  
Result displayed at point of sale machine max 4

[13]

**181.** (a) (i) Four at one each  
(Do not allow non-essential fields, e.g. description, price, etc.)  
StockCode/StockNumber/StockId  
(Allow Item/product in place of Stock prefix and Barcode)  
QuantityInStock/CurrentNumberInStock  
Reorderlevel  
ReOrderQuantity  
SupplierId/SupplierCode/SupplierNumber(Supplier details but not  
supplier) 4

(ii) Three at one each  
TransactionTypeCode  
StockCode (Allow alternatives as above)  
Quantity 3

(b) One mark for correct order  
Order = same as Master file 1

Any one point for one mark  
Because transaction file will be serial  
So one pass is possible  
Reduce time taken to update master file 1

max 2

[9]

**182.** (a) Collection of tables 1

(b) DonorId 1

Unique attribute 1

(c) (i) An attribute in one table which is  
the primary key 1

in another table 1

Or

a common or shared attribute 1

used to model a relationship 1

max 2

(ii) DonorId 1

(iii) DonationId 1

Or

DonorId, DateDonationGiven 1

max 1

(d) (i) To speed up searching (Do not allow so any record can be found easily) 1

(ii) DonationType 1

(e) (i) 2 1

(ii) 12 1

[11]

**183.** (a) (i) Physical components/devices of the computer; **(1)**

(ii) Programs which run on the computer; **(1)** 2

(b) (i) Modem; OR ISDN adapter; **(1)**

(ii) To convert digital signals/waves to analogue signals; and vice versa;   
**R**  binary instead of digital  
If ISDN above: To connect to the digital telephone network;  
so digital signals from the computer can travel to the digital  
telephone exchange. **(2)** 3

(c) (i) Browser software; http communication software; **(1)**

**R**  internet server **R** dial–up networking software

(ii) (hypertext transfer) protocol / protocol used; **R**  http format **(1)**

(iii) domain name/address / name/address of web server/site; **(1)** 3

*(NOT URL or anything else)*

(d) (i) nodes/machines/computers connected/communicating; over  
large geographical area/by satellite/telephone line/on different  
sites; **R** different buildings **(2)**

(ii) need a common standard / because machines are different;  
so computers can understand each other; **(1)** 3

**R**  *definition of protocol on its own*

[11]

**184.** (a) (i) Bits are sent one after another / bits are sent one at a time/  
bit by bit / bits sent singly / bits along a single wire /  
line; **R** data **(1)**

(ii) Bits transferred simultaneously / concurrently / bits sent down  
many wires at the same time; data is sent one word/byte at a  
time; **R** sending blocks of data **R** down 2 wires **(1)** 2

(b) Speed of (serial) transmission/rate at which data is sent; the number  
of signal/voltage changes per second; **A** units of time   
one baud is (approx) one bits per second; 1

**R** rate of data transmission

(c) (i) 1 0 1 0 0 1 1 0

 **(2)**

*one mark for correct ASCII binary code in 6 rightmost bits  
one mark for even number of 1s in 8 bits*

(ii) **0 0** 1 0 1 0 0 1 1 0 **1**; OR **0** 1 0 1 0 0 1 1 0 **1 1**; OR **(1)**  
**1 1** 1 0 1 0 0 1 1 0 **0**; OR **1** 1 0 1 0 0 1 1 0 **0 0**; 3

[6]

**185.** (a) System software / program which controls the computer hardware;

Manages computer (system) / hardware;

Interface between user and computer;

Runs programs; handles input/output; Max 1

(b) (i) Executes instructions/programs/code; **R** data

Performs calculations/instructions; **(1)**

**R** controls … **R** processes …

(ii) Stores/holds program /instructions / data; **R** permanently

**R** files **(1)** 2

(c) **Data bus**; **(1)**

carries the data/instructions to/from component; **R** holdsAddress bus; **(1)**

carries identification/address about where the data is being sent to   
/fetched from; **R** holds **(1)**

**Control bus**; **(1)**

to send control signals; whether process is read or write; **(1)**

carries timing signal; **R** holds **R** controls flow of data **(Max 1)** 6

[9]

**186.** (a)



(1 mark for correct position of London,   
1 mark for correct position of Berlin and Paris,  
1 mark for Amsterdam and Lisbon correct,   
1 mark for Madrid and Rome correct)  
*no follow through in this part of the question* 4

(If consistent mirror image give marks)  
(Note (b) and (c) must follow on)

(b) Root node marked correctly  
*Tick by question* **(1)**

(c) London, Paris Madrid; *in correct order* **(1)**

[6]

**187.** No carry back/forward

(a) Any two methods @ one each  
Not validation on its own, not proof reading, not backing up/back up  
  
Data entry methods:  
Accept description in place of names

Range checks;  
Presence checks;  
Uniqueness checks;  
Type check;  
Format check;  
Data verified /by entering twice and comparing;  
Length check;  
List of valid values/enumerated list of values/radio buttons/  
list boxes; (Not combo box, menu of any kind)

Data protection methods:  
Not parity

Check digit, (e.g. ISBN);  
Check sum;  
Virus checking;  
Hash total;  
Control total;  
Batch total;

Data consistency methods:

Cascaded deletes;  
Referential integrity checking; 2

(b) Data Protection Act (DP Act/DPA)/Personal Data Protection Act/  
Data Protection Legislation; (Not Data Protection on its own) (Ignore year) 1

[3]

**188.** No proprietary names, e.g. Windows NT.

(a) Type: Network(allow networking, networked but NOT LAN and WAN capability); **(1)**

Reason: Do not allow “to allow each computer to print to printer”

Print requests must be re–directed to part of network   
controlling the printer ;  
Needs to control print queue;  
To allow communication between computers;  
To allow sharing of resources (Allow share printer connected via  
server but not just to share printer); **(1)** 2

(b) Type: Real time (not process control); **(1)**

Reason: System must respond in a timely manner/quickly to variations   
 in temperature and humidity level to achieve   
 equilibrium; **(1)** 2

(c) Type: batch; **(1)**  
(Ignore qualifications like “serial/linear–based”)

Reason: OMR forms can be processed in one go (but NOT inputting in one go);  
 No user/human intervention/interaction; **(1)** 2

[6]

**189.** (a) Not entities.

Collection of tables/relations;  
Tables/relations are related to one another;  
A database in which relationships are modelled  
by shared(common) attributes/fields; 1

(b) Primary key = CustomerId;  
Justification = Unique field/Every CustomerID will be different; 2

(c) (i) A field which is in two tables is worth one mark.

Foreign key = An attribute/field in one table;  
 which is the primary key in another table;

Field which links/relates;  
to tables; 2

(ii) CustomerId; 1

(iii) AdvertId; 1

(d) (i) Not easier/easier to access

To speed up searching;  
To make searching quicker; 1

(ii) Name; 1

(e) (i) 2; 1

(ii) For any column, both rows must be correct to get column mark.

No marks if there are three rows. There should be one header row and one criterion row.  
Allow criterion row above header row.  
Allow **GT 12/7/2000 in place of** >**12/7/2000**Allow **GTE 13/7/2000 and >=13/7/2000 in place of >12/7/2000  
Do not accept “after” FOR >. Do not accept ranges, e.g. 13/7/2000–1/12/2000**Order is immaterial. Ignore any extra columns.

 4

[14]

**190.** (a) Array must be sorted **(1)**, on the field being used as the search key **(1)**

(b) Description must include the following points:  
Find median record of array **(l)**Compare key field of record at median position with required search key,  
exit if found **(1)**  
If search key lower (ie required record in first half), discard second half,  
else discard first half **(1)**  
Repeat process **(1)**-until either found, or no further division  
possible so record does not exist **(1)**

(c) On each iteration, half the possible matches are eliminated,  
compared with only one for the linear search **(2)**  
*Linear search on average scans n/2 records, compared with log2n which is  
smaller  
“Looks at fewer records” without further explanation -* **(1)**

[9]

**191.** (a) Causes process to repeat indefinitely **(1)** *(NOT repeats until* maintain *is TRUE)*

(b) maintain has two values, TRUE / FALSE **(1), =>** must be Boolean **(1)**n is used as an array subscript **(1) =>** must be integer **(1)** *or n is used as a loop control and can never be non-integer within the algorithm* **(1)  
 *=>*** integer **(1)***(NOT numeric - too vague)*

(c) see table for model solution  
**(1)** *each indicated section completed correctly, including follow–through* ***(7x1)****;  
additional* **(1)** *for**correctly modifying n downwards in penultimate section  
If candidates go completely wrong but clearly deserve some credit marks can be  
awarded on the following criteria, up to a maximum of***(2)** for correct sequence of loop repetitions, including the change from 6 to 5 then 6  
- ie the column for n, including correct exit  
**(2)** for correct completion of the sequence of stations, ie the *org, dest, start, finish*columns

**(2)** for correct completion of *totalkm* column, ie correct lookups and totalling  
(**2)** for correctly executing inner if branches, ie setting *maintain* and resetting  
*totalkm* in correct places  
  
Total **(8)** for all-correct trace  
follow-through marks should be awarded where appropriate

(d) **(2)** for diagram, or explanation, showing that the journeys indicated above  
cover all routes in both directions  
*marks can be awarded for any reasoned answer (indicating achievement or not)  
providing it is consistent with the candidates's trace table*Note: the sequence is  
MK -> SW -> CW -> SW -> TW -> HK -> MK -> QB -> SW etc., which does cover all lines in both directions. Strictly speaking, whether the objective is achieved depends whether journeys to/from MK depot are passenger-carrying / revenue-earning or not.  
Either interpretation is acceptable - the marks are awarded for the explanation.

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n | org | dest | last | start | finish | totalkm | maintain | Remarks |  |
|  | 0 | 3 | 1 |  |  |  |  |  |  |
|  |  |  |  |  |  |  | FALSE |  |  |
|  |  |  |  | MK |  |  |  |  |  |
|  |  |  |  |  | SW |  |  |  |  |
|  |  |  |  |  |  | 15 |  |  |  |
|  | 3 |  |  |  |  |  |  |  |  |
| 0 |  |  |  |  |  |  |  |  | Given |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  |  |  |  |  |  |  |
|  |  | 4 |  |  |  |  |  | if ignored |  |
|  |  |  |  | SW |  |  |  | if ignored |  |
|  |  |  |  |  | CW |  |  |  |  |
|  |  |  |  |  |  | +27 = 42 |  |  |  |
|  | 4 |  |  |  |  |  |  | N<6 so rpt | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2 |  |  |  |  |  |  |  |  |  |
|  |  | 3 |  |  |  |  |  | if ignored |  |
|  |  |  |  | CW |  |  |  | if ignored |  |
|  |  |  |  |  | SW |  |  |  |  |
|  |  |  |  |  |  | +27 = 69 |  |  |  |
|  | 3 |  |  |  |  |  |  | N<6 so rpt | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 |  |  |  |  |  |  |  |  |  |
|  |  | 1 |  |  |  |  |  | if ignored |  |
|  |  |  |  | SW |  |  |  | if ignored |  |
|  |  |  |  |  | TW |  |  |  |  |
|  |  |  |  |  |  | +37=106 |  |  |  |
|  | 1 |  |  |  |  |  |  | N<6 so rpt | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 |  |  |  |  |  |  |  |  |  |
|  |  | 5 |  |  |  |  |  | if ignored |  |
|  |  |  |  | TW |  |  |  | if ignored |  |
|  |  |  |  |  | HK |  |  |  |  |
|  |  |  |  |  |  | +34=140 |  |  |  |
|  | 5 |  |  |  |  |  |  | N<6 so rpt |  |
| 5 |  |  |  |  |  |  |  |  | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | 2 |  |  |  |  |  | if ignored |  |
|  |  | 0 |  |  |  |  |  | >140 so if executed |  |
|  |  |  | 5 |  |  |  |  |  |  |
|  |  |  |  |  |  |  | True |  |  |
|  |  |  |  | HK |  |  |  |  |  |
|  |  |  |  |  | MK |  |  |  |  |
|  |  |  |  |  |  | +12=152 |  |  |  |
|  | 0 |  |  |  |  |  |  | N<6 so rpt | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6 |  |  |  |  |  |  |  | TRUE so if executed |  |
| 5 |  |  |  |  |  |  |  |  | **1 mark** |
|  |  |  |  |  |  | 0 |  |  |  |
|  |  |  |  |  |  |  | False |  |  |
|  |  | 2 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | if ignored |  |
|  |  |  |  | MK |  |  |  |  |  |
|  |  |  |  |  | QB |  |  |  |  |
|  |  |  |  |  |  | +28 = 28 |  |  |  |
|  | 2 |  |  |  |  |  |  | N<6 so rpt | **1 mark** |

-

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 6 |  |  |  |  |  |  |  |  |  |
|  |  | 3 |  |  |  |  |  | if ignored |  |
|  |  |  |  | QB |  |  |  | if ignored |  |
|  |  |  |  |  | SW |  |  |  |  |
|  |  |  |  |  |  | +43 = 71 |  |  |  |
|  | 3 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | N = 6 so stop repeat loop |  |
|  |  |  |  |  |  |  |  | end while | **1 mark** |

[15]

**192.** (a) Passwords  
Encryption  
Personal Details  
Account details on-line  
Read only  
Firewall  
Any 3 3

(b) Keep data up to date  
Keep data securely  
Provide copies of personal data  
Register data with Registrar  
Keep relevant data  
Only use data for correct purposes   
Permanently delete data when out of date  
Any 3 3

[6]

**193.** (a) (i) Customer Number 1

(ii) VIN or Registration Number 1

(b) Name   
Address/Post Code   
Telephone Number   
Customer Number if not key field in (a)   
Buyer/Seller   
Car Identifier (Registration No or VIN)   
Payment details   
E-Mail address   
Date of birth   
Gender   
New/existing customer   
or any appropriate   
Any 6 3

(c) VIN If not key field in (a)  
Registration No If not key field in (a)  
Make  
Model  
Colour  
Year  
Buying Price  
Selling Price  
Buyers Customer Number  
Sellers Customer Number  
or any appropriate  
Any 6 3

(d) Customer file has record key of car file   
Car file has record of customer file  
or separate sales filewith both keys 2

[10]

**194.** (a) A language that (explicitly) describes the  
properties the desired output must have but does  
not state how the output is to be obtained.

*Rules/properties OK accept “describes what to do but not how to do it”* 1

(b) Expert systems / database queries / parallel  
processing / artificial intelligence 1

[2]

**195.** (a) Elephant 4 2  
Deer 1  
Bear 5  
Rabbit 0  
Cow 2

1 mark for rabbit having a pointer of 0   
1 mark for the others correct

(b) Start = 3 1

Freestorage = 6 1

(c) Check for free space any 5 × 1

Put data into the array at the position indicated by freestorage (animals[6])

Find position where “Monkey” must go in list (between Elephant and Rabbit)

Method for finding position

Alter “elephant” pointer to point to “Monkey”

Make “Monkey” pointer point to “rabbit”

Alter the freestorage pointer to point to next  
space / to indicate no more free space (0 / –1)

This may be answered as a pseudocode algorithm but any  
method that makes the steps clear is acceptable

[9]

**196.** (a) See trace table 10

(b) Insertion sort 1

(c) Time taken 1

to move many items / to make space for one insertion. 1

[13]

Trace table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Comment** | **count** | **rp** | **max** | **cp** | **temp** | **numbers** | | | |
|  |  |  |  |  |  | **1** | **2** | **3** |  |
| Global values on call |  |  | 3 |  |  | 13 | 25 | 24 |  |
| rp:=1 |  | 1 |  |  |  |  |  |  | 1 mark for assigning and incrementing rp and assigning cp |
| repeat |  |  |  |  |  |  |  |  |  |
| rp:=rp+1 |  | 2 |  |  |  |  |  |  |  |
| cp:=1 |  |  |  | 1 |  |  |  |  |  |
| while rp>cp do |  |  |  |  |  |  |  |  |  |
| if numbers[rp] > numbers[cp] then |  |  |  |  |  |  |  |  |  |
| temp:= numbers[rp] |  |  |  |  | 25 |  |  |  | 1 mark for temp |
| for count:=rp to cp+1 step- 1 | 2 |  |  |  |  |  |  |  | 1 mark for count starting from 2 and numbers [2] correct (no need to show count dropping to 1) |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| numbers[count]:= numbers[count-1] |  |  |  |  |  |  | 13 |  |  |
| endfor | 1 |  |  |  |  |  |  |  |  |
| numbers[cp]:=temp |  |  |  |  |  | 25 |  |  | 1 mark for copying temp to numbers[1] |
| endif |  |  |  |  |  |  |  |  |  |
| cp:=cp+1 |  |  |  | 2 |  |  |  |  | 1 mark for incrementing cp (carry forward error) |
| endwhile |  |  |  |  |  |  |  |  |  |
| until rp=max |  |  |  |  |  |  |  |  |  |
| rp:=rp+1 |  | 3 |  |  |  |  |  |  | 1 mark for rp incremented |
| cp:=1 |  |  |  | 1 |  |  |  |  | And cp assigned 1 |
| While rp>cp do |  |  |  |  |  |  |  |  |  |
| if numbers[rp] > numbers[cp] then |  |  |  |  |  |  |  |  |  |
| endif |  |  |  |  |  |  |  |  |  |
| cp=cp+1 |  |  |  | 2 |  |  |  |  | 1 mark for cp incremented |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| endwhile |  |  |  |  |  |  |  |  |  |
| if numbers[rp] > numbers[cp] then |  |  |  |  |  |  |  |  |  |
| temp:= numbers[rp] |  |  |  |  | 24 |  |  |  | 1 mark for numbers[3] copied to temp |
| for count:=rp to cp+1 step-1 | 3 |  |  |  |  |  |  |  | 1 mark for count starting from 3 and numbers [3] |
| numbers[count]:= numbers[count-1] |  |  |  |  |  |  |  | 13 | correct (no need to show count dropping to 2) |
| endfor | 2 |  |  |  |  |  |  |  |  |
| numbers[cp]:=temp |  |  |  |  |  |  | 24 |  | 1 mark for numbers[2] assigned 24 |
| endif |  |  |  |  |  |  |  |  | And cp incremented |
| endif |  |  |  |  |  |  |  |  |  |
| cp:=cp+1 |  |  |  | 3 |  |  |  |  |  |
| endwhile |  |  |  |  |  |  |  |  |  |
| until rp=max |  |  |  |  |  |  |  |  |  |

**197.** Cost/more cable needed  
skew – individual bits may travel at different speeds within the wires/bits  
out of sync inductive distortion between parallel signals   
Not routing problems or lost or corrupted data/bits Any 2

[2]

**198.** Packet – Data split into packets  
 Each packet finds its own route Any 2  
 From computer to computer / node to node  
 Could be by example such as internet

[2]

**199.** Store table of user-ids and student names  
Record user – id of person who is on particular machine  
Record web – sites visited by machine  
Cross-referencing allows trace back to individual  
Depending on the candidates school set up various combinations are possible  
but the two points are (i) being able to record Internet activity and (ii) linking  
this to an individual 2

Not simply “by audit trace/trail” since auditing system given in question

[2]

**200.** Hackers – can Change  
 Delete  
 Insert  
 data and programs without authorisation Good desc 2 Poor desc 1

Reduced by passwords etc 1

Emanations – Signals from monitors/transmission lines etc picked up by outside sources  
 Industrial espionage Good desc 2 Poor desc 1

Use TEMPEST compliant measures  
Reduced by (metal/conducting) mesh round sensitive areas /Faraday cage  
Encryption of data before transmission Any 1

[6]

**201.** (a) A server provides services required by client computer/workstation/  
terminal/client application (NOT USER, NOT CLIENT on its own);  
such as printing, file/data storage, file server, communications-e-mail  
server, Web access server, Internet server, ISP, database, controlling  
logging in;  
*(any one example providing services required by....)* 2

(b) Any 4 points @ 1 each

NO MARKS FOR A POINT WHICH REFERENCES JUST DATA  
WHEN IT SHOULD REFERENCE A PROGRAM

BACKING STORE IS NOT ACCEPTABLE AS A SUBSTITUTE  
FOR DISK (MUST BE A DIRECT ACCESS DEVICE)

ACCEPT PARTITIONS AS A SUBSTITUTE FOR PAGES  
(BUT NOT PORTIONS)

A **memory management technique**;  
**transparent** to the user/programmer which permits;  
-the execution of a process/processes where the total virtual  
**address space** **exceeds the physical MAIN memory capacity;**  
-execution of a program **which is not entirely in main memory/  
less than the full** virtual **address space of** **a process resident in  
physical memory/ execution of partially loaded processes**/  
lets user **think there is more main memory/RAM;**

**Disk** is used as **RAM;**  
**Physical memory** is conceptually **divided into** a number of fixed  
size **pages/segments;**The virtual address space of a **program/process** **is divided** into a  
number of fixed size **pages**;  
**Page table** indicates which pages of a process are loaded and where;  
The program and data reside on **disk** and are **swapped** into memory  
and out of memory as required.(DISK THRASHING);  
NB Allow an answer which uses segmentation. No marks for answers  
describing overlay techniques

*Not computer fooled into thinking more main memory* MAX. 4

[6]

**202.** (i) Bits are sent one after another/bits sent one at a time/bits sent singly/  
bits sent along single wire(line) 1

(ii) Bits transferred simultaneously/Bits transferred down  
many wires at the same time 1

*Not single stream of bits For bit of data/bits of data ignore “of data”*

[2]

**203.** (a)



2

(b) (i) A class is a set of objects that share a common structure  
and a common behaviour;  
A class is a set/collection of objects with same attributes/properties/characteristics/fields &  
methods(accept procedures or functions for methods)  
/behaviours/operations/code;

*Not set of objects with same data* 1

(ii) Inheritance is a relationship/link among classes wherein one class  
shares the structure and behaviour of another class;  
It is where one class is derived from another class.  
It is where one class uses attributes/properties/etc/ from another class;  
It is where one class uses methods/procedures/etc from another class;  
It is where one class inherits from a parent class(hierarchy must be clear 1

(c)



1 mark for clock in root position. 1 mark for both  
Analogue and Digital clocks in leaf positions.  
1 mark for correct arrow-headed lines.

*Must be correctly vertically aligned for these two marks* 3

[7]

**204.** (a) (i) A method of connecting/linking computers/networks together which are geographically remote/wide(large) geographic area/country wide/using satellites/using telephone lines;

*Not microwaves  
Not specific distances, e.g. 1 km* 1

(ii) Modem converts digital signals into tones/analogue signals and vice versa;  
Or  
Modem converts incoming tones/analogue signals into digital signals;  
and vice versa;

*Accept correct diagram* 2

(iii) Any one reason

Sending a number of pictures over a communications link can be  
time consuming;  
Sending a number of pictures over a communications link can  
also be costly in telephone connection charges;  
Digitised colour pictures take up too much storage space on  
portable computer’s backing store/requires a lot of memory  
(RAM or backing store);  
Could lose link; MAX. 1

(iv) Picture divided up into cells/pixels;  
A fixed number of bits allocated to each cell/pixel;  
bit pattern/number to indicate colour/greyscale;  
Cells mapped onto a block of memory;  
which records the bit pattern for each cell/pixel; MAX. 3

(v) Any one purpose

using to send messages/e-mail/communicate;  
to consult on-line databases/knowledge bases;  
to order equipment;  
to book flights/consult flight timetables;  
videoconferencing possible;  
make data more widely available/publicise their work/  
expedition, e.g. Web site on Internet;

*Not backup already in question* MAX. 1

(b) Each mark is for an appropriate data type

Record

TagCode: String / Text /Character array/ Array of Char/ Pic X(6)/Pic 9(6) / BCD/LongInteger;

*Not character field*

BodyLength: Real/Floating Point/Fixed Point/Single/Float;

Weight : Integer;

Sex : user-defined sub-range type with just two values, e.g. ‘A’..’B’,  
0..1/EnumeratedType/Boolean/YesNo/TrueFalse;

LongTail Boolean/YesNo/TrueFalse/user-defined sub-range type, e.g. ‘A’..’B’,  
0..l/EnumeratedType;

End 5

(c) Starting list of numbers 260 210 270 180 230

|  |  |
| --- | --- |
| **Variable j** | **List of weights after each iteration of Repeat loop** |
| 1 | 210 260 180 230 270 |
| 2 | 210 180 230 260 270 |
| 3 | 180 210 230 260 270 |
| 4 | 180 210 230 260 270 |

*Once trace has gone wrong do not award any more marks  
If mirror image then mark first row incorrect but follow through rest .  
If candidate has traced algorithm correctly but made a typographic slip.  
E g consistently written 170 instead of 180 then mark first instance  
wrong and then follow through rest* MAX. 4

(d) Introduce a Boolean variable NoMoreExchanges which is set equal  
to True before For loop;  
it is set equal to False inside For loop if an exchange of elements  
of array Animals takes place;  
use the value of NoMoreExchanges to terminate the RepeatUntil  
loop if no more exchanges have taken place;

*Introduce Counter reset to e.g. zero   
Increment Counter if an exchange takes place;  
Use value of counter to terminate*

 3

[20]

**205.** (a)



*No marks for Id on its own.  
No marks for Name, Address on their own. But abreviations for Producer,  
etc which are clear are allowed* MAX. 4

(b) (i) **Producer** (ProducerID, ProducerName)

*No extra attributes* 1

(ii) **Venue** (VenueId, VenueName, VenueAddress/Address)

*No extra attributes*

(iii) \_\_\_\_\_1\_\_\_\_\_\_\_\_ 1  
**Client** (ClientId, ClientName, AgentId)

*Max 1 if extra attributes* 2

(iv) \_\_\_\_\_\_\_\_\_1\_\_\_\_\_\_\_ 1  
**VenueHired**(ProducerId,ApptDate, VenueId)

*1 for correct primary key* 3

OR

\_\_\_\_\_\_\_\_\_1\_\_\_\_\_ 1  
**VenueHired**(VenueId,ApptDate, ProducerId)

*1 for correct primary key  
For each extra attribute lose mark from allocation except primary key mark  
Accept Date and Time* MAX. 1

(v) \_\_\_\_\_\_\_\_\_\_\_\_1\_\_\_\_\_\_\_\_\_\_\_  
**ClientAuditionAppointment** (ClientId,ApptDate, ApptTime, ProducerId)  
 and/or VenueID

*1 for correct primary key  
Accept Date and Time* 3

(c) **Select** *ClientId, ClientName, Client/Agent.AgentId, AgentName*

1 1  
**From** *Client, Agent***Where** *Client.AgentId = Agent.AgentId*  
 1 1

*Mark only first Select... if more than one  
1 for 4 correct attributes  
1 for correct table name in front of AgentId* 6

[20]

**206.** Ill trained/ inexperienced users  
Fire/Explosion  
Burglary  
Hardware Failure  
Software Failure  
Viruses  
Hackers  
Disgruntled Employees  
Any 3  
1 mark for each risk + 1 mark each suitable defence

[6]

**207.** (a) user connected to system  
data not necessarily updated immediately 3

(b) user connected to system  
data updated immediately  
in each case 2 marks for good description,  
1 mark for incomplete description + 1 for suitable example 3

[6]

**208.** See trace table below. Sections corresponding to marks are shaded.

1 mark for newstring, message and procedure call correct. 1 mark for x and piece correct. 1 mark for outstring correct. 1 mark for changing x and a. 1 mark for tracing the second call to docharacter. 1 for section correct. 1 mark for third call correct. 1 mark for endprocs all correctly traced. 1 mark for outputs correct



[9]

**209.** Computer  
Modem/ISDN line  
communications software / e-mail software  
bank’s software  
**not** telephone line Any 3 × 1

[3]

**210.** (i) Integrity describes the consistency of data before and after processing 1 **Data that has not been accidentally or maliciously corrupted** **is said to have integrity.** 1

(ii) Any method which achieves the above is acceptable  
Good description 2Muddled description 1 2+2

[4]

**211.** (i) Mouse; joystick; Modem link - single stream of bits down single wire **Not** speaker

(ii) Local printer, scanner, hard drive, - several streams of data down several wires simultaneously  
*Only use printer* ***once***

For each, 1 mark for example 1 mark for description 2 × 2

[4]

**212.** Hardware and 2software conventions (rules)  
used to control the transmission of data 2

[4]

**213.** (a) A database where the data is structured as a series of tables/entities and the 1DBMS provides tools for joining tables together and selecting items from 1within tables

(b) bar code, location, edition, size, weight, editors, pages, publisher, author,  
number of copies, category, buying price, selling price, hard or  
paperback, year of publication   
**(Do NOT allow ISBN or TITLE)** Any 4 × 1

(c) Book many to one publisher  
1 mark for diagram 1 mark for relationship 2

(d) Order book identifier, order no  
Customer order identifier, name + address or customer id  
Sales person sale identifier, staff no  
Sale order identifier, sale no  
Any other sensible entity for a bookshop Entity 1  
 Relationship 1  
 Key field 1

[11]

**214.** (a) program designed to replicate itself (and spread on its own),  
preferably without anyone aware of its existence.  
Damage files / hardware or amuse user Any 2 × 1

(b) For each method given  
 2 marks for good description  
 1 mark for confused description  
Methods can be drawn from any of the four groups. Any 4 × 2

Preparation/ prevention - Write protect all floppy disks; make  
regular back ups; restrict use of floppy disks; Scan new software  
source disks with anti- virus software on a stand alone/ non- network  
computer; networks restrict floppy drives.

Detection - Be aware of evidence for known viruses e.g. date virus;  
look for unexpected signs of virus activity: unexpected disk accesses:  
changes to program **files:** presence of unusual files in directories.

Containment - Disconnect an infected machine if necessary; stop  
immediately a computer’s activity on detection of any of the above;  
scan any new software to be installed on the computer network for  
viruses; restrict the use of floppy disks on networked computers.

Recovery - Replace infected files with clean back ups; scan all files  
on computer with virus software;” Tracing possible sources of  
infection” if qualified appropriately could appear in more than  
one category,

(c) could be a new virus not known to the virus detection software;  
a virus which loads before the virus detection system is itself loaded;  
may be able to hide its activity from the protection software by  
residing in the boot sector of a disk.

Virus checker needs to be switched off before installing software Any 2 × 1

[12]

**215.** (a)

|  |  |  |  |
| --- | --- | --- | --- |
| Low | High | Middle | Found |
|  |  | *5* |  |
| *6* |  | *8* |  |
|  | *7* | *6* |  |
| *7* |  | *7* | true |

1 mark for each entry above (as far as first incorrect entry)  
**mark row by row**

max **(7)**

(b) *binary search/chop;  
iterative (no synonyms)*(specific searches not on AS syllabus - *search* sufficient for mark)

[8]

**216.** Random access files

(a) *even spread;  
few collisions;  
quick to compute;  
generates all addresses in range;*

One mark per point max **(2)**

(b) *too many additions and deletions;  
so records are not at their home address / in overflow area;  
so search times become too long;*

One mark per concept max **(3)**

[5]

**217.** (a) Network connecting together geographically remote computers  
(separate sites/connected by phone lines/satellites/Internet) 1

(b) Rules **(1)** used to define the ways in which different **(1)**  
computer networks/computers may be connected to each other.  
(For rules do not accept standard) 2

(c) Need common standard **(1)** / because machines/networks different.  
(Needs idea of transmission) /toenable successful communication 1

[4]

**218.**

|  |  |  |  |
| --- | --- | --- | --- |
| Repeat S****Q Until Qempty | Queue emptied  to a stack | Elements taken from front of queue and placed/pushed on stack | 1  1 |
| Repeat Q****S Until S empty | stack emptied  to a queue | Elements popped/taken from top of stack placed in queue | 1  1 |
| Or suitable diagram |  |  | 1 |

[4]

**219.** (a) (i) A class is a set of objects which share a common structure and a common  
behaviour / Object type that defines a data structure /fields /properties and  
the methods /procedures /functions that act on these fields 1

(ii) Inheritance is a relationship among classes wherein one class shares the structure/data structure /fields /properties and behaviour/methods/procedures/functions/actions of another class  
Or  
Inheritance is when a class has the same characteristics as its parent class 1

(b) 3



[5]

**220.** (a) 

Labelling must clearly indicate term 3

(b) 

Must clearly indicate subsets 2

(c) A procedure which is defined in terms of/ calls itself /re-entrant 1

(d) State of machine/return address/parameter **(1)**  
needs to be stored/held **(1)**  
to enable a previous execution of T to be resumed **(1)**

Or  
so that each call to T **(1)**  
can pass **(1)**  
a new value of the parameter **(1)** 3

(e)



 10

(f) In-order traversal 1

[20]

**221.** (a) 10011101110 1

(b) bans (must be lower case) 1

(c) 

swap **b** and **n** is worth 2 marks 2

(d) 26bits 1

(e) (i) ASCII **(1)**  
 UNICODE **(1)**  
 EBCDIC **(1)**  
 Baudot **(1)** 1

(ii) Frequency of appearance of characters in plain text/most common  
characters **(1)**  
Those characters which appear most frequently should be near the  
top of the tree. **(1)** 2

(iii) In plain text message where the average length of tree code **(1)** is less 2  
than **(1)** that of the fixed length code.  
no of occurrences of character  
Yes, provided that (sum of frequency of occurrence multiplied by bits  
saved per character is





(ii) *Real numbers used for scientific calculations:*   
Floating point **(1)**  
Mantissa \* **(1)  
(1) (1)** 2Exponent

Or Mantissa and exponent **(1)**  
move point **(1)**  
correct no of places **(1)** 4

(iii) *Scanned picture:*  
Bit-map **(1)**  
*Any 2 points @ 1 each*Picture divided up / pixels **(1)**  
Colour/greyscale of each part **(1)**  
Coded in bits/binary **(1)** 3

[20]

**222.** (a)  5

(b) (i)  2



2



4

 3



4

[20]