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| **Christmas Revision Pack** |
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Santa has decided to give Computer Science Students one last chance to move from the naughty list to the nice list!
All you have to do is complete all the questions!

Mark scheme available here:
[**https://SYHOXAM.exampro.net**](https://syhoxam.exampro.net/)

Allow 1 ½ mins per mark.
Try to do 1 question at a time (Ideally in exam(ish) conditions
Use notes / eBooks/ PGonline/ GoL to check your answers an improve
Only then use the mark scheme to see how you did…

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|  |
| Time: | **100 minutes** Marks **72 marks** |
| **Q1** |
| **Q2** |
| **Q3** |
| **Q4** |
| **Q5** |
| **Q7** |
| **Q7** |
| **Q8** |

**Q1.**

**Figure 1** shows a binary tree containing seven nodes. **Figure 2** shows how the binary tree in **Figure 1** could be represented using three one-dimensional arrays: Data, Dir1 and Dir2.

**Figure 1**

****

**Figure 2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Index** | **Data** |   | **Dir1** |   | **Dir2** |
| [0] | C |   | 1 |   | 4 |
| [1] | I |   | 2 |   | 3 |
| [2] | E |   | -1 |   | -1 |
| [3] | H |   | -1 |   | -1 |
| [4] | B |   | 5 |   | 6 |
| [5] | Y |   | -1 |   | -1 |
| [6] | Q |   | -1 |   | -1 |

(a)  Define the term binary tree.

**(2)**

(b)  The output of a post-order traversal algorithm used to print the data item at each node in the binary tree shown in **Figure 1** would be E, H, I, Y, Q, B, C.

State the output that would be produced by an **in-order** traversal algorithm.

**(2)**

**Figure 3** shows pseudo-code for a subroutine called Traversal that uses the three arrays from **Figure 2**.

**Figure 3**

SUBROUTINE Traversal(StartNode)

  Current ← StartNode

  Pos ← 0

  Stack[Pos] ← Current

  WHILE Pos ≠ -1

    Current ← Stack[Pos]

    Pos ← Pos – 1

    OUTPUT Data[Current]

    IF Dir2[Current] ≠ -1 THEN

      Pos ← Pos + 1

      Stack[Pos] ← Dir2[Current]

    ENDIF

    IF Dir1[Current] ≠ -1 THEN

      Pos ← Pos + 1

      Stack[Pos] ← Dir1[Current]

    ENDIF

  ENDWHILE

ENDSUBROUTINE

(c)  Complete the unshaded cells in the table below to show the result of the subroutine call Traversal(0)

|  |  |  |  |
| --- | --- | --- | --- |
|   |   | **Stack** |   |
| **Current** | **Pos** | **[0]** | **[1]** | **[2]** | **[3]** | **Output** |
|   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |
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**(7)**

**Figure 3 (repeated)**

SUBROUTINE Traversal(StartNode)

  Current ← StartNode

  Pos ← 0

  Stack[Pos] ← Current

  WHILE Pos ≠ -1

    Current ← Stack[Pos]

    Pos ← Pos – 1

    OUTPUT Data[Current]

    IF Dir2[Current] ≠ -1 THEN

      Pos ← Pos + 1

      Stack[Pos] ← Dir2[Current]

    ENDIF

    IF Dir1[Current] ≠ -1 THEN

      Pos ← Pos + 1

      Stack[Pos] ← Dir1[Current]

    ENDIF

  ENDWHILE

ENDSUBROUTINE

(d)  The subroutine shown in **Figure 3** could have been written so that it used recursion instead of iteration.
Explain what is meant by a recursive subroutine.

**(1)**

(e)  Explain what is meant by a base case for a recursive subroutine.

**(1)**

(f)  If the subroutine shown in **Figure 3** had been written using recursion, a stack frame would have been stored each time a recursive subroutine call was made.

State **two** components of a stack frame.

**(2)**

**(Total 15 marks)**

**Q2.**

State **two** advantages of using Reverse Polish Notation (RPN) instead of infix notation to represent an expression.

**(Total 2 marks)**

**Q3.**

A network uses the CSMA / CA access method with Request to Send / Clear to Send (RTS / CTS).

A computer on the network has data to send to another computer. Explain how the CSMA / CA access method with RTS / CTS will be used during this transmission.

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**(Total 6 marks)**

**Q4.** A school stores information about its sports day in a relational database.
The details of the track events are stored using the three relations in **Figure 1** .

|  |
| --- |
| **Figure 1** |
| Athlete (AthleteNumber, Forename, Surname, Class, Gender, DateOfBirth) |
| Race (RaceNumber, Gender, Distance, Type, StartTime) |
| RaceEntryAndResult (RaceNumber, AthleteNumber, TimeSet) |

Each athlete who takes part in a race is given a unique AthleteNumber. Athletes can run in more than one race. If they do, they keep the same AthleteNumber for the entire day.

Many races are run throughout the day. An example race would be the boys 80m hurdles, the third race of the day, which starts at 13:30. The entry in the Race table for this race is shown in the table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RaceNumber** | **Gender** | **Distance** | **Type** | **StartTime** |
| 3 | Boys | 80 | Hurdles | 13:30 |

When an athlete is entered into a race, a record of the entry is created in the RaceEntryAndResult table. Initially, the TimeSet is recorded as 00:00.00 (meaning 0 minutes, 0 seconds, 0 hundredths of a second) to indicate that the race has not yet been run. After the race has been run, if the athlete successfully completes it, then their TimeSet value is updated to record the time that they achieved in minutes, seconds and hundredths of a second. The TimeSet value remains at 00:00.00 for athletes who fail to complete the race.

The primary keys in the Athlete and Race relations have been identified in **Figure 1** by underlining them. The correct primary key for the RaceEntryAndResult relation has not been identified.

(a)     In **Figure 2** below, underline the appropriate attribute name(s) to identify the correct primary key for this relation.

|  |
| --- |
| **Figure 2**RaceEntryAndResult (RaceNumber, AthleteNumber, TimeSet) |

**(1)**

(b)     Relations in a database should usually be fully normalised.
Define what it means for a database to be fully normalised.

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(c)     On the incomplete Entity-Relationship diagram below show the degree of the **three** relationships that exist between the entities.

|  |  |  |
| --- | --- | --- |
| Athlete |   | RaceEntryAndResult |
|   |   |   |   |   |   |   |   |   |   |
|   | Race |   |

**(2)**

(d)     Athlete number 27 is to be entered into race number 6.

Write the SQL commands that are required to make this entry.

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(e)     **Figure 1** is repeated below.

|  |
| --- |
| **Figure 1 (repeated)** |
| Athlete (AthleteNumber, Forename, Surname, Class, Gender, DateOfBirth) |
| Race (RaceNumber, Gender, Distance, Type, StartTime) |
| RaceEntryAndResult (RaceNumber, AthleteNumber, TimeSet) |

Athlete number 27 sets a time of 0:18.76 (0 minutes, 18 seconds, 76 hundredths of a second) for race number 6.

Write the SQL commands that are required to update the athletes entry for this race, to store this time in the TimeSet field.

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**(3)**

(f)     The competition organisers want to produce a list of all of the athletes who took part in race number 6 with the athlete who won (set the lowest time) at the top and the other athletes below the winner in the order in which they finished.

Only athletes who finished the race should be included in the list.

The following information should appear for each athlete: AthleteNumber, Forename, Surname and TimeSet.

Write an SQL query to produce the list.

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**(5)**

(g)     The database system is to be extended for use in an inter-school athletics league. Users at any school in the county will be able to access the system to input the results of races.

It is possible that two users might try to access or update the system at the same time.

Explain the conditions under which simultaneous access to a database could cause a problem, and how this could be dealt with.

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**(3)**

**(Total 18 marks)**

**Q5.** A student uses the following URL to download a copy of a previous year’s COMP2 exam paper.

https://www.aqa.org.uk/gce/computing/2012comp2.pdf



|  |  |  |
| --- | --- | --- |
| A | B | C |

(a)     (i)      Describe the **three** labelled parts of this URL.

A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

C \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(ii)     State the top-level domain part in the URL.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     To access the exam paper, the student’s computer might need to make use of a Domain Name System (DNS) query which is transmitted to a DNS server.

(i)      What is the role of a DNS server?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     In some circumstances the student’s computer will not need to contact a remote DNS server to access a resource.

Describe **two** situations when a DNS query will **not** be sent to a remote DNS server.

Situation 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Situation 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(c)     In the process of requesting a web page, a browser will generate an HTTP GET request.

(i)      In which layer of the TCP / IP stack is the browser operating?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Explain why the student’s computer might need to make several HTTP GET requests to display one web page.

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**(1)**

(iii)    The HTTP GET requests are being sent to port 80 on the remote machine. The browser has been allocated a **client port number**.

What is meant by a client port number?

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**(1)**

**(Total 10 marks)**

**Q6.**

Interrupts can be generated by devices connected to the processor during the Fetch-Execute cycle.

Describe the role of interrupts.

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**(Total 2 marks)**

**Q8. (***I have swapped q7 and q8 so it fits better)*

Big Data is an important application area for modern computer science.

•   Describe what Big Data is, using examples to illustrate your description.

•   Explain some of the challenges that Big Data brings with it and the approaches that can be taken to overcome these, in relation to programming and hardware.

•   Consider some of the ethical and legal issues that might arise in applications that store data, particularly data about people.

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**(Total 12 marks)**

**Q7.Standard AQA assembly language instruction set**. This should be used to answer question part (a).

|  |  |
| --- | --- |
|  LDR Rd, <memory ref> | Load the value stored in the memory location specified by <memory ref> into register d. |
| STR Rd, <memory ref> | Store the value that is in register d into the memory location specified by <memory ref>. |
| ADD Rd, Rn, <operand2> | Add the value specified in <operand2> to the value in register n and store the result in register d. |
| SUB Rd, Rn, <operand2> | Subtract the value specified by <operand2> from the value in register n and store the result in register d. |
| MOV Rd, <operand2> | Copy the value specified by <operand2> into register d |
| CMP Rn, <operand2> | Compare the value stored in register n with the value specified by <operand2>. |
| B <label> | Always branch to the instruction at position <label> in the program. |
| B<condition> <label> | Branch to the instruction at position <label> if the last comparison met the criterion specified by <condition>.Possible values for <condition> and their meanings are:EQ: equal toNE: not equal toGT: greater thanLT: less than |
| AND Rd, Rn, <operand2> | Perform a bitwise logical AND operation between the value in register n and the value specified by <operand2> and store the result in register d. |
| ORR Rd, Rn, <operand2> | Perform a bitwise logical OR operation between the value in register n and the value specified by <operand2> and store the result in register d. |
| MVN Rd, <operand2> | Perform a bitwise logical NOT operation on the value specified by <operand2> and store the result in register d. |
| LSL Rd, Rn, <operand2> | Logically shift left the value stored in register n by the number of bits specified by <operand2> and store the result in register d. |
| LSR Rd, Rn, <operand2> | Logically shift right the value stored in register n by the number of bits specified by <operand2> and store the result in register d. |
| HALT | Stops the execution of the program. |

**Labels:** A label is placed in the code by writing an identifier followed by a colon (:). To refer to a label, the identifier of the label is placed after the branch instruction.

**Interpretation of <operand2>**

<operand2> can be interpreted in two different ways, depending on whether the first character is a # or an R:

•   # - Use the decimal value specified after the #, e.g. #25 means use the decimal value 25

•   Rm – Use the value stored in register m, e.g. R6 means use the value stored in register 6

The available general purpose registers that the programmer can use are numbered 0 to 12

The figure below shows an algorithm, written in pseudo-code, that is used to multiply two box variables W and X together. The resulting answer is stored in variable Y. It can be assumed that both W and X are positive integers. Z is a temporary variable. The operation DIV performs integer division.

Line numbers are included but are not part of the algorithm.

1 W ← 9

2 x ← 12

3 Y ← 0

4 REPEAT

5   z ← W LOGICAL BITWISE AND 1

6   IF Z = 1 THEN

7     Y ← Y + X

8   END IF

9   W ← W DIV 2

10   X ← X \* 2

11   UNTIL W = 0

Write a sequence of assembly language instructions that perform multiplication using the same method shown in the algorithm above.

Assume that registers 0, 1, 2 and 3 are used to store the values represented by variables W, X, Y and Z accordingly.

Some lines, including those equivalent to line numbers 1 to 5 in the algorithm above, have been completed for you.

 MOV R0, #9

  MOV R1, #12

 MOV R2, #0

      startloop: AND R3, R0, #1

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

         jump:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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             B startloop

        endloop:

**(Total 7 marks)**

Mark schemes

**Q1.**

1. Rooted (tree);

Where each node has at most two child nodes; **R.** each node has two child nodes **2**

(b)  EIHCYBQ;;

If not fully correct award a maximum of 1 mark for any of the following:

•   Having E followed by I then H

•   Having Y followed by B then Q

•   Having C as the 4th output **2**

(c)

****

**Mark as follows:**

1. Stack[0] set to 0, Pos set to 0 and Current set to 0

2. Current set to 0, Pos set to -1 and output of C

3. Stack[0] set to 4 and Pos set to 0

4. Stack[1] set to 1, then 3 and then 5 with no other values after being set to 5

5. Stack[2] set to 2 with no other values after this, Stack[0] having a 3rd value of 6 with no other values after this and Stack[3] column not used;

6. Pos column correct from 4th value (1) onwards and Current column set to the value 1, then 2, 3, 4, 5, 6 with no further values after being set to 6

7. Correct order in output column for 2nd value onwards (I, E, H, B, Y, Q)

**Max 6 if any errors**

**7**

(d)  A subroutine that calls itself;

**1**

(e)  The circumstance(s) when a recursive subroutine does not call itself;

**1**

(f)  local variables;

return address;

parameters;

register values; **A.** example of register that would be in stack frame

**Max 2**

**2**

**[15]**

**Q2.** Simpler for a machine/computer to evaluate (**A.** easier **R.** to understand);

Simpler to code algorithm;

Do not need brackets (to show correct order of evaluation/calculation); **A.** RPN expressions cannot be ambiguous as BOD

Operators appear in the order required for computation; No need for order of precedence of operators;

No need to backtrack when evaluating; **Max 2 [2]**

**Q3.**

|  |  |  |
| --- | --- | --- |
|  | **Description** | **Mark**  |
| 3 | A detailed, coherent, description that includes the use of RTS / CTS and that conveys good understanding of how the access method works. Whilst there may be some omissions from the description it contains no misunderstandings. | 5-6 |
| 2 | An adequate description, including at least three points from the list below. The description is logically organised so that it makes sense when read as a whole and therefore demonstrates a reasonable understanding of how the system works. The description may or may not include the use of RTS / CTS. | 3-4 |
| 1 | A small number of relevant points have been recalled (in this case award one mark per point, up to a maximum of two from lists below). However, the structure of the response, or lack of it, demonstrated only a very limited understanding, if any, of the access method used. | 1-2 |

**Indicative Content**

•   computer with data to send monitors/listens for (data signal)

•   if (data) signal present/another transmission in progress then continue to wait

•   when no (data) signal present computer sends a Request to Send / RTS **A**. if no valid points made about RTS / CTS in response then accept that when no data signal is present computer starts to transmit data, but with no marks awarded for RTS / CTS then response is limited to max Level 2

•   two computers could start transmitting simultaneously if they both detect there is no data signal

•   receiver/WAP responds (to RTS) with a Clear to Send / CTS signal **A.** router

•   RTS / CTS signal blocks any other transmissions from nodes in range

•   if / when CTS received then start to transmit **A.** by implication as **BOD** if the student states that the computer will begin to transmit after the receiver sends the CTS

•   if CTS not received continue to wait (until transmission ends)

•   receiver sends acknowledgement / ack after (all) data received

•   after transmitting (the transmitter) waits to receive acknowledgement packet (to confirm data received and not corrupted)

•   if no acknowledgement / ack received (within reasonable time period) then:

◦   wait a time period

◦   then listen again / retransmit

•   the acknowledgement / ack also notifies other computers that they can transmit again

•   waiting periods are (often) random **A.** an example waiting period that is random

•   collisions cannot be detected by transmitter

**[6]**

**Q4.** (a)     RaceEntryAndResult(RaceNumber, AthleteNumber, TimeSet)

**1 mark** for underlining both RaceNumber and AthleteNumber.

**1**

(b)     **Any 2 from:** Data is atomic / / no repeating groups (of attributes);
**R** No repeated columns / attributes / data / values

No partial (key) dependencies / / No (non-key) attribute depends on part of the primary key but not the whole of it / / all non-prime attributes are (functionally) dependent on the whole of every candidate key / / (non-key) attributes depend on the whole key;

No non-key dependencies / / No transitive dependencies / / (non-key) attributes depend on nothing but the key;

Every (non-key) attribute is dependent upon the key;

Every determinant is a candidate key;

**A** ‘field’ for ‘attribute’

**A** ‘part’ for ‘partial’

**MAX 2**

**2**

(c)     **1 mark** for any one correctly drawn relationship **OR**

**2 marks** for all three relationships drawn correctly



**2**

(d)     **Method 1:**

INSERT INTO RaceEntryAndResult
VALUES (6,27,"00:00.00")

**Method 2:**

INSERT INTO RaceEntryAndResult (RaceNumber, AthleteNumber, TimeSet)
VALUES (6,27,"00:00.00")

**Method 3 (Default Time Assumed):**

INSERT INTO RaceEntryAndResult(RaceNumber, AthleteNumber)
VALUES (6, 27)

**1 mark** for correct INSERT INTO clause

**1 mark** for correct VALUES clause

**A** default time delimited by any type of quotation mark or hashes or no delimiter

**A** any sensible variation on the default time eg "0:00", "00:00:00", or just 0

**A** the values 6 and 27 if they are delimited by any type of quotation mark

**A** list of fields in any order for method 2, but to get the VALUES mark in method 2, order of fields list in INSERT INTO must match order of values in VALUES

**2**

(e)     **1 mark** for correctly identifying the table in the data model that needs to be updated (RaceEntryAndResult) and the conditions that should be used to identify the correct record to in the table to update – with both conditions linked by the correct logical operator

**Note:** The AO2 mark for understanding the data model should be awarded regardless of whether correct SQL syntax is used or not as they are for data modelling, not syntactically correct SQL programming

1 mark for correct SQL syntax in two of the three clauses (UPDATE, SET, WHERE)

**OR**

**2 marks** for correct SQL syntax in all three clauses – to get two marks, there must be fully correct SQL syntax and all three clauses must be present, but it might be possible that the AO2 mark was not awarded eg if OR was used instead of AND

Example Solution

UPDATE RaceEntryAndResult
SET TimeSet = "00:18.76"
WHERE AthleteNumber = 27 AND RaceNumber = 6

Additional Guidance

**AO3 marks:**

**A** any type of quotation marks or hashes for delimiters for TimeSet or no delimiters
**A** the values 27 and 6 if they are delimited by any type of quotation mark
**A** any sensible format for the time data eg "18.76", "18:76", "0:18:76" etc.

(f)      **1 mark** for correctly understanding the data model and identifying the tables that data needs to be extracted from and the fields that need to be extracted, and including these and no other tables or fields in the query

**1 mark** for correctly identifying how the data in the required tables should be combined to produce the desired result (the linking condition)

**1 mark** for identifying the correct conditions to use within the model for the RaceNumber and TimeSet fields to retrieve the required data and for using the correct logical operators between all of the conditions

**Note:** The AO2 marks for understanding the data model should be awarded regardless of whether correct SQL syntax is used or not as they are for data modelling, not syntactically correct SQL programming

**1 mark** for correct SQL syntax in two of the four clauses
(SELECT, FROM, WHERE, ORDER BY)

**OR**

**2 marks** for correct SQL syntax in all four clauses – to get two marks, there must be fully correct SQL syntax and all four clauses must be present, but there could be mistakes in the marks awarded for AO2 e.g. an incorrect or missing condition

Example Solutions

**Example 1**

SELECT AthleteNumber, Forename, Surname, TimeSet
FROM Athlete, RaceEntryAndResult
WHERE RaceNumber = 6
AND TimeSet "00:00.00"
AND Athlete.AthleteNumber = RaceEntryAndResult.AthleteNumber
ORDER BY TimeSet

**Example 2**

SELECT AthleteNumber, Forename, Surname, TimeSet
FROM Athlete INNER JOIN RaceEntryAndResult
    ON Athlete.AthleteNumber = RaceEntryAndResult.AthleteNumber
WHERE RaceNumber = 6
AND TimeSet "00:00.00"
ORDER BY TimeSet

Additional Guidance

Mark(s) can be awarded for the correct logical conditions even if the required tables are not identified as being used by the query
Accept alternatives for not equal to that are correct in the context of the data model eg > or !=
Accept any sensible variation on the default time eg "0:00", "00:00:00", or just 0
Ignore unnecessary clause Race.RaceNumber = RaceEntryAndResult.RaceNumber

Accept table names before fieldnames.
Accept use of Alias/AS command eg FROM Athlete AS A or FROM Athlete A then use of A as table name.
Accept INNER JOIN written as one word i.e. INNERJOIN.
Accept ORDER BY written as one word i.e. ORDERBY.
Accept ASC at end of ORDER BY clause.
Accept insertion of spaces into fieldnames.
Accept use of ", ' or # as delimiters for times.
Accept use of " or ' as delimiters for around number 6.
Ignore unnecessary brackets.
**DPT** for unnecessary punctuation – allow one semicolon at the very end of the statement, but not at the end of each clause.
**DPT** for fieldname before table name.

**Refer responses using nested SQL queries to team leaders.**

**5**

(g)     **Problem Conditions (1 mark):** When two users try to update the same record simultaneously;

**How dealt with (2 marks):** Alternative 1 - Record Locks

Maintain information about which records are currently being accessed;

When a user tries to access a record, consult this information and only permit access if record is not currently being used / / only permit read access to a record that is already open;

Alternative 2 - Transaction Queuing

Updates / database changes are (grouped as transactions and) queued;

Database software processes transactions in FIFO order from queue;

**Award 1 mark for ‘use of record locks’ if no other marks awarded for how dealt with. 3 [18]**

**Q5.**(a)     (i)      **A**       the protocol to be used / / secure hyper-text transfer protocol / / hyper-text transfer protocol secure;

          **NE** hyper-text transfer protocol

**B**       the FQDN / / fully qualified domain name;

          **A** the address of (AQA’s) web server

**C**       the path and resource to be returned;

          **A** path / pathname / file path **3**

(ii)     uk / / .uk ; **1**

(b)     (i)      To take a required FQDN and to return an IP address;

To link / map a FQDN to an IP address;

**A** domain name for FQDN

**R** URL **1**

(ii)     The (local) computer already has a copy of the needed IP address (in a hosts file);

The (local) computer has a cache of recent DNS queries / answered DNS queries;

**A** previously visited site / refreshing a page;

The URL typed in already contains an IP address;

The URL refers to a local resource, e.g., a file on the local computer / / localhost ;

**NE** intranet **MAX 2**

(c)     (i)      application (layer);

**A** fourth layer; **1**

(ii)     To fetch different parts of the web page that also include an URL;

To fetch a needed image / video / javascript / css / resource;

**R** transmission error

**R** network busy **MAX 1**

(iii)    Port that is temporarily assigned / only exists for duration of a connection;

Port number automatically allocated / / assigned from the TCP / IP stack;

**A** a port number in range 1024 - 65535

**MAX 1**

**[10]**

**Q6.** Allows the currently executing process/task/program to be suspended;

**A.** “stopped” as BOD

**R.** Suspend/stop the fetch-execute cycle / processor

**R.** “instruction” for “process”

So that a device/source that needs the (immediate) attention of the processor can be serviced/dealt with // so that an urgent error condition can be serviced/dealt with;

**A.** Examples of error conditions that would be likely to generate an interrupt

**NE.** To deal with an error, unless stated or clear from example that must be dealt with immediately

**NE.** So that a task of higher priority can be carried out **[2]**

**Q8.**

|  |  |  |
| --- | --- | --- |
|  **Level** | **Description** | **Mark**  |
| 4 | A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers all three areas indicated in the guidance below and in at least two of these areas there is sufficient detail to show that the student has a good level of understanding. To reach the top of this mark range, a good level of understanding must be shown in all three areas. | 10-12 |
| 3 | A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response which shows a good level of understanding of two areas indicated in the guidance below or a good level of understanding of one area and a reasonable level of understanding of the other two areas. To reach the top of this mark range, a good level of understanding must be shown in two areas. | 7-9 |
| 2 | A limited attempt has been made to follow a line of reasoning and the response has a mostly logical structure. A good level of understanding has been shown of at least one area or some understanding has been shown of all three areas. | 4-6 |
| 1 | A few relevant points have been made but there is no evidence that a line of reasoning has been followed. The points may only relate to one or two of the areas from the guidance. There is insufficient evidence of a good understanding of any of the three areas. | 1-3 |

**Guidance – Indicative Content**

**Area 1: What Big Data is**

Overarching description: Data that can’t be processed or analysed using traditional processes or tools.

|  |  |
| --- | --- |
| **Characteristic** | **Expansions / Examples** |
| Variety of different forms of information // data may lack structure | Cannot be represented in a table // by a relational databaseEmail messagesVideosImagesWeb site contentsFacial recognition |
| There is a lot / high volume of data (to process as one dataset) // data will not fit on one server | Hundreds of terabytesLarge medical datasets for diagnosisGene sequencingPredicting disease outbreaksResults of large-scale scientific experiments |
| The data is generated / received / must be processed at high velocity / very quickly | Thousands of items to process per second.Data must be processed as it is received – it cannot be batched and processed laterCard payment fraud detection Recommendations systems |

*Good level of understanding = Either all three characteristics covered or two characteristics and the overarching description. Some examples or expansions covered.*

**Area 2: Challenges and How Overcome**

Challenges:

•   Data cannot be stored on one server / computer.

•   Not possible to process data quickly enough with one computer.

•   Data cannot be represented in a table // by a relational database.

•   Some forms of data / unstructured data are difficult to analyse.

How overcome**:**

•   Distributed database systems // distributed file systems // blocks of individual files distributed across multiple servers.

•   Use of functional programming.

•   (Massively) parallelising the execution of programs.

•   MapReduce // input split into parts then mapper executed on each part then all results combined by reducer(s) // function-to-data model.

•   Functional programming makes it easier to write distributable code // determine which parts of code can be run independently.

•   Functional programming makes it easier to write correct code // example features of functional programming that facilitate writing correct code

•   Use of many thousands of commodity servers.

•   Use of servers with multiple CPUs / cores / drives.

•   Machine learning can identify patterns / the value in the data // use of predictive data models.

•   Use of languages such as XML or JSON to describe semi-structured data.

•   Use of fact-based model can manage bigger data sets better than a relational model.

*Good level of understanding = A range of challenges and how to overcome them are discussed.*

**Area 3: Ethical and Legal Issues**

•   How can data be kept securely?

•   Who should have access to what data?

•   Will people know what data is being stored about them?

•   Where should / will the data be stored // concerns relating to data being stored in other countries.

•   What rights do people have in relation to data stored about them?

•   Example laws (allow two examples): Computer Misuse Act, General Data Protection Regulations / GDPR / Data Protection Act, Regulation of Investigatory Powers Act / RIPA.

•   Who owns data about individuals?

*Good level of understanding = A range of issues described* **[12]**

**Q7. Example Solution 1**

LDR R1, 102

LDR R2, 103

loop:

startloop:   AND R3, R0, #1

**CMP R3, #1**

**BNE jump**

**ADD R2, R2, R1 // ADD R2, R1, R2**

jump:        **LSR R0, R0, #1**

**LSL R1, R1, #1**

**CMP R0, #0**

**BEQ endloop**

B startloop

endloop:

**Alternative Answer 1:**

LSL R1, R1, #1 could be replaced with ADD R1, R1, R1

**Alternative Answer 2:**

BNE jump could be replaced with:

BEQ doadd

B jump

doadd:

**1 mark:** Recognising that logical shift (LSR/LSL) is needed to perform integer division by 2 / multiplication by 2 even if the syntax used is incorrect.

**1 mark:** Recognise that two comparisons and two branch instructions are needed even if the syntax is incorrect or the wrong types of branch instructions are used.

**1 mark:** CMP R3, #1 before the jump: label and syntactically correct.

**1 mark:** BNE jump before the jump: label and syntactically correct.

**1 mark:** ADD R2, R2, R1 is before the jump: label and syntactically correct.

**1 mark:** LSR R0, R0, #1 **and** LSL R1, R1, #1 are after the jump: label and syntactically correct. I. order of commands

**1 mark:** CMP R0,#0 and BEQ endloop are after the jump: label, before B startloop and syntactically correct.

**Max 4** marks for programming if any syntax incorrect or program does not work correctly under all circumstances

**A.** Answers that use hexadecimal or binary values

**DPT** Missing hash for immediate addressing

**DPT** incorrect use of commas, colons, semi-colons, line numbers, etc.

**[7]**