AQA

A-level
Computer Science
Paper 2 (7517/2)
Mark scheme

7517
June 2017

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

A-level Computer Science

Paper 2

June 2017

To Examiners:

- **When to award '0' (zero) when inputting marks on CMI+**
  A mark of 0 should be awarded where a candidate has attempted a question but failed to write anything credit worthy.

  Insert a hyphen when a candidate has not attempted a question, so that eventually the Principal Examiner will be able to distinguish between the two (not attempted / nothing credit worthy) in any statistics.

- This mark scheme contains the correct responses which we believe that candidates are most likely to give. Other valid responses are possible to some questions and should be credited. Examiners should refer responses that are not covered by the mark scheme, but which they deem creditworthy, to a Team Leader.

The following annotation is used in the mark scheme:

; - means a single mark
// - means alternative response
/ - means an alternative word or sub-phrase
A - means acceptable creditworthy answer
R - means reject answer as not creditworthy
NE - means not enough
I - means ignore
DPT - in some questions a specific error made by a candidate, if repeated, could result in the loss of more than one mark. The **DPT** label indicates that this mistake should only result in a candidate losing one mark on the first occasion that the error is made. Provided that the answer remains understandable, subsequent marks should be awarded as if the error was not being repeated.

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Examiners are required to assign each of the candidates' responses to the most appropriate level according to **its overall quality**, then allocate a single mark within the level. When deciding upon a mark in a level examiners should bear in mind the relative weightings of the assessment objectives.

eg
In the following questions, the marks available are as follows:
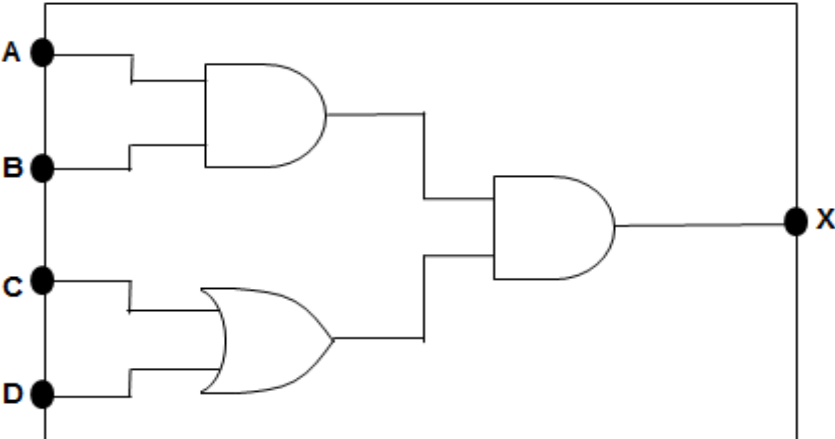
Question 1.1 (max 4 marks)
AO1 (understanding) – 4 marks

Question 7 (max 12 marks)
AO1 (understanding) – 12 marks

01	1	All marks AO1 (understanding)	4

Level	Description	Mark Range
4	Description covers all, or almost all, of the points in the indicative guidance and fully reflects the sequence in which steps occur. It includes use of registers, buses and main memory. An excellent level of understanding is shown with no misconceptions.	4
3	Description covers most (ie more than half) of the points in the indicative guidance and completely or almost completely reflects the correct sequence in which steps occur. At least two of the use of registers, buses and main memory are covered. A good level of understanding is shown. Whilst there may be some omissions, there is at most one misconception in the response.	3
2	At least two correct points are made from the indicative guidance and there is some indication of understanding of the correct sequence. Some understanding is shown.	2
1	At least one relevant point has been made. There is not sufficient evidence to conclude that the cycle has been understood.	1

Guidance – Indicative Response

- Contents of Program Counter/PC transferred to Memory Address Register/MAR
- Address bus used to transfer this address to main memory
- Fetched value/instruction transferred using the data bus
- Contents of addressed memory location loaded into the Memory Buffer Register/MBR
- Transfer content of Memory Buffer Register/MBR to the Current Instruction Register/CIR

A. Memory Data Register / MDR for MBR
I. Incrementing of program counter, even if incorrect
NE. Points made using register transfer notation only eg CIR ← [MBR]

01	2	All marks AO1 (understanding)	2

To execute/carry out the instruction other data may need to be fetched (from main memory);
A. During execute phase MBR used to store other data
A. Further instructions may need to be fetched before the instruction has finished executing, if pipelining/parallelisation is referenced explicitly in the response

Further memory fetches would overwrite the contents of the MBR // the instruction would be overwritten by further memory fetches // writing the result of executing the instruction back to main memory would overwrite the instruction / MBR contents;

A. MBR is not (directly) wired to the (processor) components that will execute the instruction which CIR is
A. The MBR is not (directly) wired to the ALU as BOD

		R. The MBR cannot decode instructions	
01	3	**All marks AO1 (understanding)** Instruction and data can be accessed simultaneously; Avoid/reduce bottleneck of single data/address bus(es) // avoid/reduce delays waiting for memory fetches; Avoids possibility of data being executed as code (which is one method that can be exploited by hackers); Being able to use exclusively ROM for instruction memory prevents the program being modified/hacked; **A.** Program cannot be accidentally overwritten (by data) Instruction and data memory can have different word lengths; Different technologies can be used to implement instruction and data memory; Different quantities of instruction and data memory means that address lengths can differ between the two // memory address structures can differ; **MAX 2** **NE.** So programs/tasks will run faster **NE.** More efficient	2
02	1	**Mark is for AO2 (apply)** KAITLEN; **I.** Case	1
02	2	**All marks AO1 (knowledge)** The key must be (at least) as long as the data to be encrypted/plaintext; The key must not be reused // key must only be used once; The key must be (truly) random; The key must be kept securely / not revealed / only known by user(s); **MAX 2**	2
02	3	**Mark is for AO1 (knowledge)** Symmetric: The same key is used to encrypt and decrypt; **A.** Sender and receiver use same key Asymmetric: Different (but related) keys are for encryption and decryption; **A.** Sender and receiver use different keys **NE.** Symmetric uses one key // asymmetric uses two keys **MAX 1**	1
03	1	**Mark is for AO1 (understanding)**	1

		3;	
03	2	**Mark is for AO2 (apply)** 1500 (bits per second); **A.** 3 * 500 **A.** Value given in response to question part 3.1 multiplied by 500.	**1**
03	3	**Mark is for AO1 (understanding)** B; **R.** If more than one lozenge shaded.	**1**
03	4	**All marks AO1 (understanding)** Data skew might occur if parallel communication used; **A.** Eliminates risk of desynchronisation (between data signals) **A.** Bits transmitted <u>simultaneously/together</u> may arrive at different times **NE.** Bits will not arrive together The longer the distance the higher the likelihood of data skew; To avoid problems of cross-talk // interference between individual wires; Hardware (for serial communication) is cheaper to manufacture // cheaper cabling (for serial communication which is more important over long distances); **A.** "Easier" for "cheaper" **NE.** Just statement that fewer wires required without expansion eg lowering cost **NE.** References to data being corrupted without further explanation eg data skew, cross-talk **MAX 2**	**2**
04	1	**All marks AO2 (apply)** **1 mark:** inputs A and B connected to an AND gate; **1 mark:** inputs C and D connected to an OR gate; **1 mark:** output of an AND gate (but not the same one as connected to inputs A and B)	**3**

		connected to X;	
		MAX 2 if circuit does not fully represent the logic of the system OR the circuit diagram contains any errors	
04	**2**	**All marks AO2 (apply)** $X = A \cdot B \cdot (C + D)$ **1 mark:** either $A \cdot B$ or $C + D$ somewhere in an incorrect expression **2 marks:** fully correct expression **A.** A logically equivalent expression for **2 marks**	**2**
04	**3**	**All marks AO2 (apply)** **Marking guidance for examiners** • Award marks for working out until an incorrect step has been made. • If, in any one step, a candidate is simplifying different parts of an expression simultaneously award all relevant marks for this multiple stage but don't award any further marks for working in any parts simplified incorrectly. For example, if the expression P.P.(P+Q) + P.P.1 was changed to P.(P+Q)+P.0, the candidate would get one mark for simplifying the first part to P.(P+Q) and could get further marks for correctly simplifying this part of the expression further but should not be awarded marks for simplifying the incorrectly changed part P.0 (ie to 0) **1 mark** for final answer: $B + C$ **MAX 3** for working. Award up to two marks for applying each one of the three techniques (one mark per application): • a successful application of De Morgan's Law (and any associated cancellation of NOTs) that produces a simpler expression. • applying an identity other than cancelling NOTs that produces a simpler expression. • successfully expanding brackets. **Note:** A simpler expression is one that is logically equivalent to the original expression but uses fewer logical operators. **Example Working (1)** $\overline{(\overline{A} + A \cdot (A + B))} + \overline{(\overline{B} \cdot \overline{C})}$ $= \left(\overline{A} + A \cdot (A + B)\right) \cdot \overline{(\overline{B} \cdot \overline{C})}$ Application of DeMorgan $= \left(\overline{A} + A \cdot (A + B)\right) \cdot (B + C)$ Application of DeMorgan $= (\overline{A} + A) \cdot (B + C)$ By identity $A = A \cdot (A + B)$ $= 1 \cdot (B + C)$ By identity $\overline{A} + A = 1$ $= B + C$ By identity $1 \cdot X = X$ **Example Working (2)**	**4**

		$\overline{\overline{(\overline{A} + A \cdot (A + B))} + (\overline{B} \cdot \overline{C})}$ $= \overline{\overline{(\overline{A} + A \cdot A + A \cdot B)} + (\overline{B} \cdot \overline{C})}$ Expansion of brackets $= \overline{\overline{(\overline{A} + A + A \cdot B)} + (\overline{B} \cdot \overline{C})}$ By identity $A \cdot A = A$ $= \overline{\overline{(1 + A \cdot B)} + (\overline{B} \cdot \overline{C})}$ By identity $\overline{A} + A = 1$ $= \overline{\overline{(1)} + (\overline{B} \cdot \overline{C})}$ By identity $1 + X = 1$ $= \overline{0 + (\overline{B} \cdot \overline{C})}$ By identity $\overline{0} = 1$ $= \overline{(\overline{B} \cdot \overline{C})}$ By identity $0 + X = X$ $= B + C$ Application of DeMorgan	
04	4	**Mark is for AO1 (knowledge)** Used to store state (of data input) // used as a memory (unit); **R.** If stated that maintains state when power turned off	1
04	5	**All marks AO1 (knowledge)** Input is: Clock / trigger / enable; **R.** Set / reset Used For: State of data input is stored // output is updated to reflect current status of input; **A.** Synchronise operation of a group of flip-flops **R.** Changes state/value of flip-flop	2
05	1	**1 mark for AO1 (knowledge) and 1 mark for AO1 (understanding)** **AO1 (knowledge): 1 mark:** An operand is a value/data that will be used by an operation; **AO1 (understanding): 1 mark:** The addressing mode indicates how the value in the operand should be interpreted // the addressing mode indicates if the value in the operand is a memory address/register or a data/immediate value; **A.** In immediate addressing the operand is the value to use and in direct addressing it is a memory address/register number **NE**. Addressing mode indicates if direct or immediate addressing is used	2
05	2	**All marks AO2 (apply)**	4

Register Contents				Main Memory Location Contents		
R1	R2	R3	R4	100	101	102
10	40					
50		50	1			1

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1 mark: Value of 10 is first value in R1.

1 mark: Value of 40 is only value in R2.
A. Value in R2 is four times the value in R1, if value in R1 was incorrect

1 mark: Value of 50 in both R1 and R3, as the second and final value in R1 and only value in R3.
A. Value stored in R1 is five times the initial value in R1, if this was incorrect and R3 contains only 50
A. Value stored in R1 is equal to contents of R2 and previous contents of R1 added together, if either of these were incorrect and R3 contains only 50

1 mark: Value of 1 stored in both R4 and memory location 102. It should be the only value in R4 but could be preceded by 80 in memory location 102. It must be the final value in memory location 102. This mark should only be awarded if the contents of R1 and R3 are equal, otherwise see accept point below.
A. Value of 0 instead of 1 stored in both R4 and memory location 102 if contents of registers R1 and R3 are not equal
I. Values of 10 and 50 written in the columns for main memory locations 100 and 101 and value of 80 written above value of 1 in column for memory location 102

Note: Values do not have to be written in the same rows as in the table above, but must be in the same order ie for R1, the value 10 must be assigned above the value 50. Individual values eg 50 may be written out multiple times.

05	3	**Mark is for AO2 (analyse)** Check if the value stored in memory location 101 is five times the value stored in memory location 100 // check if value in memory location 100 is a fifth of that in memory location 101 (if so, store a 1 in memory location 102 if it is and a 0 if it is not); **A.** Check if a number is five times another number // a fifth of another number as BOD	1
05	4	**All marks AO1 (understanding)** **Advantages of high-level language (MAX 2):** Program code is easier to understand/maintain/debug; Faster development time // programmers can be more productive // one line of HLL code can do the same job as many lines of assembly language; Programs are (more) portable (to other hardware platforms) Availability of flow control structures; **A.** Example(s) eg loops, selection Improved features for supporting modularity; **A.** Ability to use subroutines Built-in support for data structures; **A.** Example(s) eg arrays, records Language is problem-oriented; Support for different paradigms; **A.** Examples eg functional programming	4

		Disadvantages of high-level language (MAX 2): Assembly language code may execute more quickly; **R.** If response suggests that faster execution is because translation is not required Assembly language code may use less memory; Assembly language gives direct/better access to computer hardware // enables direct manipulation of memory (contents); **NE.** "More efficient" for either executes more quickly or uses less memory Award marks for disadvantages as opposite of advantage points eg a disadvantage of assembly language could be "Program code is harder to understand/maintain". **BUT** do not award two marks for an advantage and its corresponding disadvantage.	
06	1	**Marks is for AO2 (apply)** 10; **A.** `[10]` this time	**1**
06	2	**All marks AO2 (apply)** <table><tr><th>Function Call</th><th>Result</th></tr><tr><td>map square a</td><td>[1,9,25]</td></tr><tr><td>filter (<10) b</td><td>[1,5]</td></tr><tr><td>fold (+) 0 c</td><td>18</td></tr></table> **1 mark** for each correct response in the **Result** column. **I.** Missing brackets this time or use of incorrect type of brackets **I.** If returned values are assigned to new lists eg `x = [1,9,25]` **A.** [5,1] for row 2 this time	**3**
06	3	**Mark is for AO1 (knowledge)** A function that takes a function as an argument // returns a function as a result // takes a function as an argument and returns a function as a result; **A.** "Parameter", "Input" for "Argument" **NE.** A function that uses another function **R.** Explanations that are specifically of the map function	**1**

07		**All marks AO1 (understanding)**		**12**

	Level	Description	Mark Range
	4	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers all four areas indicated in the guidance below and in at least three of these areas there is sufficient detail to show that the student has an excellent level of understanding of the issues and technologies involved. To reach the top of this mark range, an excellent level of understanding must be shown of all four areas.	10-12
	3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response but the response may only cover two or three of the areas indicated in the guidance below. A good understanding is shown of each of these areas and if only two areas are covered, the coverage of these is excellent.	7-9
	2	A limited attempt has been made to follow a line of reasoning by covering at least two of the topic areas in the guidance below. Overall, at least four valid points must have been made which can relate to any of the topic areas in the guidance.	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 four areas from the guidance or may be made in a superficial way with little substantiation.	1-3

Guidance – Indicative Response

1. How it was possible for data to be collected

WiFi signals can travel outside of property // over wide area // limited control over range

Any WiFi receiver in range can read the data packets **NE.** The receiver in the car can read the packets

No need to physically "tap" into a WiFi connection, unlike a cabled connection

A protocol that does not encrypt the transmissions may have been used // unencrypted data sent. **NE.** Network not secure

2. Steps to prevent

Use a protocol that encrypts data transmissions
A. Encrypt the transmission
R. Password protection

Example of secure protocol eg WPA, WPA2

Disable broadcast of SSID to make network harder to identify (Note: Accept this point even though the SSID would be in other data packets)

Limit power of transmitter so data does not travel outside premises (although in practice this might be hard to achieve)

Use cabled network instead of WiFi.

R. MAC address filtering (as cars were not connecting to networks just intercepting transmissions)

3. Legal and ethical issues

If the data is being transmitted through the air, who does it belong to, if anyone? // Should data transmitted by WiFi be treated like a broadcast (eg TV) or a private communication (eg telephone call)?

Is it wrong to intercept data if people freely choose to transmit it wirelessly? **A.** Is it ethical to collect data from people without their permission?

Is it legal to intercept data if people freely choose to transmit it wirelessly? What laws apply in this scenario? Is this really hacking?

Are the ethics or laws different for intercepting data transmitted wirelessly than by cable?

Is there a difference between collecting statistical data eg channel number, signal strength, SSID and collecting the payload data?

Was the data just collected or was there an intention to process it as well?

What should the company have done when it realised that the data had been collected? // Should the data have been immediately deleted, or kept so that the company could contact and apologise to people it had collected data from? // What should be done with the data now?

What should the company have done if it inadvertently discovered evidence of illegal activity in the collected data?

Legality/ethicality may depend on the nature of the data gathered // (In the UK) would some of the collected data count as "personal data" (under the Data Protection Act) // could some of the data have been sensitive (accept example eg bank account details, details of minors) **NE.** Data may be private

To what extent is the company financially liable for collecting the data? Or any consequences of its use?

Could the legal situation be different in different countries where the company operated?

Was the collection of data intentional or just an accidental side-effect of a reasonable process?

What was done to ensure (existing) policies are followed?

Should there have been more oversight of code development?

Could intellectual property have been inadvertently stolen?

Is it ethical to collect/store information secretly from people // without them knowing?

Is it ethical to collect data if there is no (legitimate) purpose for doing so?

Were the developers in breach of their contracts with the company / company guidelines?

Relevant Legislation

Students may name specific pieces of legislation that could have been breached as part of their response. Determining whether or not a breach has actually occurred would probably require more information than is provided in the question and detailed knowledge of the legislation, which is not required by the specification. Therefore, up to **two points** can be given for students naming relevant pieces of legislation that could have been breached, regardless of whether or not this can be ascertained with certainty. Relevant pieces of legislation include:

- The Data Protection Act
- The Computer Misuse Act
- The Regulation of Investigatory Powers Act
- The Communications Act

Points should be given for assertions that legislation has definitely been breached, even if this is only a possibility in the context rather than a certainty.

Responses that reference other legislation should be referred to Team Leaders.

A. As an alternative to naming the Data Protection Act, a response could instead question whether privacy laws have been breached, or if a breach of privacy has occurred.

4. Lessons

Improved training for developers in what is legal / ethical (accept company needs to improve understanding of legal/ethical issues)

Need to review guidelines that developers are expected to follow

Need for scrutiny of code / supervision by people outside of development team

Developers could be required to check each other's code

Developers could be required to log changes made to code and reason

Should only collect data that is absolutely necessary // that has a clear purpose // need to review collected data to see why it is being collected and stored // need to fully consider the purpose of any data collection before doing it

Could/should remove equipment for Wi-Fi data capture used in cars to collect mapping data.

NE. Further testing should be carried out unless there is a clear explanation of the mechanism by which testing will check that the software has no additional functionality is described eg inspection of collected data files to verify purpose of contents

08	1	**All marks AO2 (apply)** **Method (MAX 1):** A multiplication by 20 000; A multiplication by 16; A multiplication by 30; **Answer:** 1200 **A.** 1171.875 (expressed to at least 4 significant figures) <u>this time</u> **If answer is correct and some working has been shown, award all marks, even if working would not have gained credit on its own.** Accept 30*16*20000/8/1000 for **2 marks** or any other reasonable calculation that would arrive at the correct answer, even if the final answer is not stated.	2
08	2	**All marks AO1 (understanding)** **1 mark:** As a result of Nyquist's theorem // the sample rate must be at least twice the frequency of the (highest frequency component in the) original signal; **1 mark for any point in this list:** • 20 000 is less than double of 14 500 • 14 500 is more than half of 20 000 • the sample rate would need to be at least 29 000 Hz • with a sample rate of 20 000 Hz frequency components of over 10 000 Hz will not be reproduced faithfully **MAX 2**	2
08	3	**2 marks for AO1 (knowledge) and 2 marks for AO1 (understanding)** **AO1 (knowledge): Representation (MAX 2):** Music represented as sequence of MIDI (event) messages; **A.** Music represented as sequence of instructions **R.** Music represented as sequence of notes One example of data that might be contained in a message: • Channel • Note on / note off • Pitch / frequency / note number • Volume / loudness • Velocity • Key pressure / aftertouch	4

- Duration / length
- Timbre
- Instrument
- Pedal effects
- Pitch bend
- Note envelope;

MIDI messages are usually two or three bytes long;
First byte of each MIDI message is a status byte (others are data bytes);
Bit rate is 31,250 bits per second;
MSB value of 1 indicates status byte, 0 indicates data bytes;
Status bytes are divided into a command and a channel number (4 bits for each);
Sixteen channels are supported;

AO1 (understanding): Advantages of MIDI (MAX 2):

More compact representation;
Easy to modify / edit notes // Easy to change values eg octave for entire score //easy to change instruments;
Simple method to compose algorithmically;
Musical score can be generated directly from a MIDI file;
No data lost about musical notes // through sampling; **A.** "better quality" but only if it there is some explanation of this eg "no error introduced during sampling", "no background noise recorded"

09	1	**All marks AO1 (understanding)** **1 mark:** The 'Router and Firewall' port labelled **A**: 192.168.0.x where x is not 0 or 255; **1 mark:** The 'Router 2' port labelled **B**: 192.168.2.x where x is not 0 or 255;	2
09	2	**All marks AO1 (understanding)** **Physical**: The (physical) <u>layout/arrangement/architecture</u> of the cabling/wiring/connections (between the devices/computers on the network); **A**. The (physical) <u>layout/arrangement/architecture</u> of the devices/computers/network **NE.** How the devices/computers are connected to each other **NE.** "Setup" for layout **NE.** List of topologies eg bus, star **Logical**: How the data/packets flows around a network // architecture of the communication mechanism in a network; **A.** Conceptual way that data moves around a network **A.** The type of protocol used **NE.** How a network operates/behaves	2
09	3	**All marks AO1 (understanding)** **Client-server (MAX 2):**	4

Resources stored on the server;
R. Responses which suggest that everything must be done on the server
Clients access resources from server // server provides these resources in response to client requests;
A. Server provides services to client
Centralised / improved security management // centralised login system // centralised administration // administration will be easier;
Configuration/setup more complex // configuration/setup requires greater expertise;

Peer-to-peer (MAX 2):
Resources stored on each individual computer/device/peer;
Any computer/device/peer can access resources from any other // any computer/device/peer can share resources with any other // files can be distributed across the computers on the network;
Each computer/device/peer has equal status // a computer can act as both client and server;
Management of security / administration could be more difficult;
Computers communicate directly with each other // there is no dependence on a server;
NE. Computers connected directly to each other, no server

In both sections, reject points about how computers are connected to each other.

Accept responses that use examples of resources eg files, web pages

MAX 4

10	1	**Mark is for AO2 (analyse)** CarRegNo and JobDate; **A.** Just both these attribute names written with no further explanation **R.** "CarRegNo or JobDate"	1
10	2	**1 mark for AO2 (analyse) and 1 mark for AO1 (understanding)** **AO2 (analyse) – 1 mark:** A person may own more than one car // a person may bring different cars to the garage; It might be desired to store details of an owner when the car they own is not yet known; **A.** A car might be owned by more than one person (at different times) **A.** Easier to transfer car from one owner to another **AO1 (understanding) – 1 mark:** Avoid storing owner details once for each car they own / multiple times; Avoid having to input owner details once for each car they own; To transfer car between owners would only have to change one attribute in the car relation; Minimise data duplication // no unnecessary repeated data; **A.** Reduce for minimise	2

		Eliminate data redundancy; **A.** Reduce/minimise for eliminate Eliminate data inconsistency // improve consistency // avoid inconsistency problems; Eliminate update anomalies; **A.** Example in context Eliminate insertion anomalies; **A.** Example in context **NE.** Fewer errors when updating/inserting/deleting without concrete example or good explanation **NE.** Saving space/memory **NE.** Easier to query	
10	3	**All marks AO2 (analyse)** **1 mark** for any one correctly drawn relationship **OR** **2 marks** for three relationships drawn correctly **MAX 1** if more than three relationships drawn and any are incorrect 	2

10	4	**1 mark for AO2 (analyse) and 2 marks for AO3 (programming)**
		
		<u>Mark Scheme</u>
		
		AO2 (analyse) – 1 mark:
		
		1 mark for correctly identifying the table in the data model that needs to be updated (Job) and the condition that should be used to identify the correct record in the table to update (JobID = 206).
		
		Note: The AO2 mark for analysing the data model should be awarded regardless of whether correct SQL syntax is used or not as it is for data modelling, not syntactically correct SQL programming
		
		AO3 (programming) – 2 marks:
		
		1 mark for correct SQL syntax in two of the three clauses (UPDATE, SET, WHERE)
		 OR
		2 marks for fully correct SQL
		
		<u>Example Solution</u>
		
		`UPDATE Job`
		`SET JobDuration = "01:30"`
		`WHERE JobID = 206`
			3

		<u>Additional Guidance</u> **AO3 marks:** **A.** Any type of quotation marks or hashes for delimiters for `JobDuration` or no delimiters **A.** The value `206` if it is delimited by any type of quotation mark **A.** Any sensible format for the time data eg `"01.30"`, `"1:30"`, `"1:30.00"` etc. **A.** Time given as a decimal ie 1.5 **A.** Table name given before fieldname **I.** Quotation marks around fieldnames **I.** Any attempt to also change value of `InGarage`	

10	5	**All marks AO3 (programming)**
		
		Method 1:
		
		`INSERT INTO PartUsedForJob`
		`VALUES (206,12,2)`
		
		Method 2:
		
		`INSERT INTO PartUsedForJob (JobID, PartID, QuantityUsed)`
		`VALUES (206,12,2)`
		
		1 mark for correct `INSERT INTO` clause
		1 mark for correct `VALUES` clause
		MAX 1 if SQL not fully working eg because of extra clauses
		
		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`
		A. The value(s) `206` and `12` if they are delimited by any type of quotation mark
			2

10	6	**3 marks for AO2 (analyse) and 2 marks for AO3 (programming)** <u>Mark Scheme</u> **AO2 (analyse) – 3 marks:** **1 mark** for correctly analysing the data model and identifying the tables that data needs to be extracted from (`Part`, `PartUsedForJob`) and the fields that need to be extracted (`PartID`, `Description`, `Price`, `QuantityUsed`), and including these and no other tables or fields in the query **A.** Including the table `Job` which is not needed, as long as it is correctly linked in by a condition **1 mark** for correctly identifying how the data in the required tables should be combined to produce the desired result (the linking condition - `PartUsedForJob.PartID = Part.PartID`) **1 mark** for identifying the correct conditions to use within the model for the JobID field (`JobID = 93`) and for using the correct logical operators between all of the conditions (if a linking condition is also used)	**5**

Note: The AO2 marks for analysing 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

AO3 (programming) – 2 marks:

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

OR

2 marks for fully correct SQL

Example Solutions

Example 1

```
SELECT PartID, Description, Price, QuantityUsed
FROM Part, PartUsedForJob
WHERE JobID = 93
    AND PartUsedForJob.PartID = Part.PartID
ORDER BY PartID
```

Example 2

```
SELECT PartID, Description, Price, QuantityUsed
FROM Part INNER JOIN PartUsedForJob ON
PartUsedForJob.PartID = Part.PartID
WHERE JobID = 93
ORDER BY PartID
```

Overall MAX 4 if solution does not work fully

Additional Guidance

AO2 marks:

Mark(s) can be awarded for the correct logical conditions even if the required tables are not identified as being used by the query
Ignore unnecessary clause `PartUsedForJob.JobID = Job.JobID`

AO3 marks:

Accept table names before fieldnames separated by a full stop.
Accept use of `Alias`/`AS` command eg `FROM Part AS P` then use of `P` as the table name but note that command `Alias` is not required eg `FROM Part P`.
Accept `INNER JOIN` written as one word ie `INNERJOIN` or just as `JOIN`
Accept `ORDER BY` written as one word ie `ORDERBY`.
Accept `ASC` at end of `ORDER BY` clause.
Accept insertion of spaces into fieldnames.
Accept use of `"` or `'` as delimiters around number 93.

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.
For the **DPT** points, the penalisation is in terms of number of clauses of SQL code not marks ie if fieldname is before table name in two out of four clauses of SQL then this could count as three clauses of correct SQL

Refer responses using nested SQL queries to team leaders.

Refer responses using RIGHT JOIN OR LEFT JOINT to team leaders.

10	7	**All marks AO2 (analyse)**	
			3

1 mark: Create a new relation to identify which make/model(s) of car each part can be fitted to;
A. Use of a relation name that clearly identifies the purpose eg `PartToFitMakeModel` instead of an explanation
A. If it is just stated that a new relation is creation if the attributes in the relation make its purpose clear
NE. A relation to link the `Part` and `Car` relations

2 marks from:
Store the attributes `PartID`, `Make` and `Model` in the new relation;
I. Inclusion of additional attributes
Make the `PartID`, `Make` and `Model` / all the attributes the entity identifier;
A. The creation of a new field as an entity identifier for this relation if it is explained that a constraint would also need to be added to ensure that it is not possible to record twice in the relation that a particular part could be fitted to a particular make and model of car

Accept answers by example, such as: `PartToFitMakeModel(PartID, Make, Model)`

Alternative Response

1 mark:
Create two new relations, one to associate an entity identifier with each make and model of car (eg `MakeModelID`) and one to link the parts to this new relation.
A. If it is just stated that new relations will be created if the attributes in the relations make their purpose clear

2 marks from:
Store the attributes `Make` and `Model` with a new entity identifier (eg `MakeModelID`) in one of the new relations;
Store the `PartID` in the other new relation together with the entity identifier from the first new relation (eg `MakeModelID`);
Make the `PartID` and `MakeModelID` the entity identified in the second new relation;
A. The creation of a new field as an entity identifier for this relation if it is explained that a constraint would also need to be added to ensure that it is not possible to record twice in the relation that a particular part could be fitted to a particular make and model of car

Accept answers by example, such as: `UniqueMakeModel(MakeModelID, Make, Model)` and `PartToFitMakeModel(PartID, MakeModelID)`

A. Table or entity for relation.
A. Field for attribute.
A. Primary key for Entity Identifier.

11	1	**Mark is AO1 (understanding)** C;	1
11	2	**Mark is AO1 (understanding)** B;	1

11	3	**All marks AO2 (apply)**	2

Mantissa   Exponent

1 method mark for either:
- showing correct value of both mantissa and exponent in denary (mantissa = -0.625 // -5/8, Exponent = 3)
- showing binary point shifted 3 places to right in binary number ie 1011.0000 or in the positive equivalent 0101.0000
- indicating that final answer calculated using answer = mantissa x $2^{exponent}$

1 mark for correct answer

Answer = -5

If answer is correct and some working has been shown, award two marks, even if working would not have gained credit on its own.

11	4	**All marks AO2 (apply)**	3

2 marks for working:

Correct representation of 58.5 in fixed point binary: 111010.1; **A.** leading 0s.
Showing the correct value of the exponent in denary (6) or binary (110) // showing the binary point being shifted 6 places;

MAX 2

1 mark for correct mantissa and exponent together:

Mantissa

Exponent

		If answer is correct and some working has been shown, award three marks, even if working would not have gained credit on its own. **Working marks can be awarded for work seen in the final answer eg correct exponent.**	
11	5	**Mark is for AO2 (apply)** 0.05 // 13.8 – 13.75; **A.** Award BOD mark if correct method has been shown i.e. 13.8 – 13.75 but candidate has then made an error performing the subtraction operation **R.** -0.05 unless the accept point above also applies	1
11	6	**Mark is for AO2 (apply)** 0.36(%); **A.** 0.0036 // 0.05 ÷ 13.8 **A.** Follow-through of incorrect answer to question part 11.5 **A.** Award BOD mark if correct method has been shown but candidate has then made an error performing the division operation	1