AS

Computer Science (7516/2)

Paper 2

Mark scheme

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 http://www.aqa.org.uk/

COMPONENT NUMBER: **Paper 2**

COMPONENT NAME:

STATUS:

DATE: **10 September 2014**

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 a number of levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are a range of marks in each level. The descriptor for the level represents a typical mid-mark performance in that level.

Before applying 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 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 question 6.2, the marks available for the AO1 elements are as follows:

AO1 (knowledge) – 2 marks
AO1 (understanding) – 4 marks.

Where a candidate's answer only reflects the knowledge, skills or understanding associated with one element of the AO, the maximum mark they can receive will be restricted accordingly.

01	**1**		**Mark is for AO1 (understanding)** Any number from the set of natural numbers; {0,1,2,3,....}	1

01	**2**		**Mark is for AO1 (understanding)** Any number from the set of irrational numbers; Examples: square root of 2, pi, Euler's number (e)	1

02	**1**		**All marks AO2 (apply)** **1 mark for working:** conversion of D to 13 or multiplication of a number (even if not 13) by 16 and adding 6 to the result; **1 mark for answer:** 214;	2

02	**2**		**All marks AO2 (apply)** 1001; 0110; **1 mark:** correct first four bits **1 mark:** correct bits in position 5-8	2

02	**3**		**All marks AO2 (apply)** 1;0111101; **2 marks:** Correct answer only	2

02	**4**		**Mark is for AO2 (apply)** 10101011;	1

02	**5**		**Mark is for AO1 (understanding)** The result is too large to be represented; (it causes) overflow; The result represents a negative value; **Max 1 mark**	1

03	**1**		**Mark is for AO1 (knowledge)** A character code uses a unique number/code to represent each different character;	1

03	**2**		**Marks are for AO1 (understanding)** **1 mark:** b = 1100010; **1 mark:** e = 1100101;	2

03	**3**		**Mark is for AO2 (apply)** **1 mark:** 1000011;	1

<table>
<tr>
<td>04</td>
<td>1</td>
<td></td>
<td>Marks are for AO1 (understanding)
<table>
<tr><th>Label</th><th>Description</th></tr>
<tr><td>1</td><td>channel idle/not busy // no node transmitting;</td></tr>
<tr><td>2</td><td>no acknowledgement received;
NE. collision occurs</td></tr>
<tr><td>3</td><td>acknowledgement received;
NE. no collision detected</td></tr>
<tr><td>4</td><td>(wait for) random period of (time);</td></tr>
</table>
1 mark: each correct description</td>
<td>4</td>
</tr>
</table>

<table>
<tr>
<td>04</td>
<td>2</td>
<td></td>
<td>1 mark for AO1 (knowledge) and 2 marks for AO1 (understanding)

AO1 (knowledge):

1 mark: SSID is a (locally unique) identifier for a wireless network;

AO1 (understanding):

1 mark: A wireless client must have the same SSID as the one put in the access point to join;
1 mark: Broadcasting SSID announces publicly your wireless network and can be seen as a security weakness;</td>
<td>3</td>
</tr>
</table>

<table>
<tr>
<td>04</td>
<td>3</td>
<td></td>
<td>Marks are for AO1 (understanding)

In coffee shop speed could be limited for each device that is connected // throttling;
In coffee shop more clients connecting to one access point;
In coffee shop connection to Internet might have less bandwidth;
In coffee shop there may be more collisions;

NOTE accept answers made in terms of home

Max 2 marks</td>
<td>MAX 2</td>
</tr>
</table>

05	**1**		**Marks are for AO1 (knowledge)** Encryption is the encoding of a message; conversion of plaintext into ciphertext; so that other parties cannot read; message can only be decrypted by the authorised receiver; **Max 2 marks**	MAX 2

05	**2**		**Marks are for AO1 (understanding)** Greater scrutiny/checking of code; Weaknesses in the routines can be spotted and publicised; The security of the routines can be tested/validated by third parties; Other programmers can learn from the code; From a philosophical point of view source code should be available; Might encourage further development of the program; **Max 2 marks**	MAX 2

05	**3**		**Mark is for AO2 (analyse)** (Large) software libraries have many lines of code; Cryptography software is complex; (Open source software) programmers are volunteers; (Open source software) library has limited funding; tracing the effect of one line of code is hard/time consuming; (Heart beat) functionality was not critical to the running of the code // code ran without any noticeable problems so didn't raise concerns. Code review (of OpenSSL) was defective; No-one needed to change this code for two years so they presumed it worked and did not inspect it; **Any 1 from above. Max 1**	MAX 1

05	**4**		**Marks are for AO2 (analyse)** **1 mark:** Reasons for: Max one Detection of illegal activities; Monitoring of other states / countries; Protection of national interests; **1 mark:** Reasons against: Max one Invasion of privacy; Commercial secrecy;	2

06	**1**		**Marks are for AO1 (knowledge)** instructions are stored in main memory; instructions are fetched, (decoded) and executed by the processor; programs can be moved in and out of main memory; **Max 2**	MAX 2

06	**2**		**2 marks for AO1 (knowledge) and 4 marks for AO1 (understanding)** **Level** / **Description** / **Mark Range** 3 / A detailed description, indicating a comprehensive knowledge has been provided which covers all three stages. For each stage, the description covers the majority of the points listed in the guidance. The answer is well structured and points are connected in a way that demonstrates a good understanding of the complete cycle. / 5-6 2 / An adequate description indicating knowledge of the cycle has been provided that either covers one or two stages in a good level of detail, including the majority of points for each stage, or covers all three stages but at a more superficial level. The answer is satisfactorily structured and points are connected in a way that demonstrates an understanding of some parts of the cycle. / 3-4 1 / A small number of points, from one or more stages have been recalled indicating some knowledge of the cycle. However, these have not been connected and demonstrates little or no understanding of any stage of the cycle. / 1-2 FETCH: o contents of PC transferred to MAR o address bus used to transfer this address to main	6

			memory o contents of addressed memory location moved into the MBR o transfer of content used the data bus o increment PC o transfer content of MBR to CIR. DECODE: o decode instruction held by the CIR o the control unit decodes the instruction o instruction split into opcode and operand. EXECUTE: o if necessary, data is fetched o the opcode identifies the instruction to execute / operation to perform o execute instruction by relevant part of processor o result stored in accumulator	

06	**3**		**Mark is for AO1 (knowledge)** **1 mark:** A language that is very similar to/ based upon the instruction set of the computer;	1

06	**4**		**Marks is for AO1 (knowledge)** **1 mark:** (opcode) represents the instruction to be executed;	1

06	**5**		**1 mark for AO1 (knowledge) and 1 mark for AO1 (understanding)** **AO1 (knowledge):** **1 mark:** Immediate addressing: the operand value is part of the instruction // no need to go to any memory address; **AO1 (understanding):** **1 mark:** Example: MOV RX, #Y; [where X is 0-12 and Y is a decimal value]	2

06	**6**		**1 mark for AO3 (design) and 3 marks for AO3 (programming)**
			
			`  CMP R1, #5  compare r1 against 5`
			`  BNE endif  jump to end of statement if not equal`
			`  MOV R2, #10  move the value 10 to B`
			`endif:`
			
			AO3 (design) – 1 mark:
			
			1 mark: Identifying that a comparison and branch are required to have the same effect as the IF statement, even if the syntax or comparison made are incorrect
			
			AO3 (programming) – 3 marks:
			
			For the AO3 (programming) marks, the syntax used must be correct for the language as described on the question paper.
			
			1 mark: Comparing R1 against 5 and having a branch with the correct logical condition
			1 mark: For moving 10 to R2
			1 mark: For having a label for end of statement (that is used in the branch)
			
			I. Load instruction to setup R1 from X.
			I. Store instruction to store R2 into B.
			A. labels given in any sensible format
			DPT - missing hash for immediate addressing
				4

07 | | | **Marks are for AO2 (apply)** | 9

Mark Scheme

Level	Description	Mark Range
3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers both the comparison of car control and painting (see Guidance Table 1) and the use of data for car control (see Guidance Table 2). At least two points from each column of Table 1 have been made and substantiated and at least three sources of input, its processing, the derived information and why it is needed must have been addressed successfully.	7-9
2	There is some evidence that a line of reasoning has been followed. The response is relevant and most but not all points made are substantiated. The response covers both the comparison of car control and painting (see Guidance Table 1) and the use of data for car control (see Guidance Table 2) but one of these two may be covered at a fairly superficial level. EITHER: At least two points from each column of Table 1 have been made and substantiated and at least one source of input, its processing, the derived information and why it is needed must have been addressed successfully OR: At least one point from each column of Table 1 has been made and substantiated and at least two sources of input, its processing, the derived information and why it is needed must have been addressed successfully	4-6
1	There is little or no evidence that a line of reasoning has been followed. Some relevant points have been made but these may only cover one of the comparison of car control and painting (see Guidance Table 1) or the use of data for car control (see Guidance Table 2). If both have been covered, the coverage is superficial and the points made are not successfully substantiated.	1-3

Guidance

Guidance Table 1: Automated car control vs programmed control of a robot for spraying car bodies	
Robot for spraying car bodies	**Automated car control**
Exactly same operation performed over and over again by programmed robot sprayer	The environment in which the car operates is not predictable//is more complex//has greater uncertainty
Position of car bodies predetermined//car bodies in known precise positions all the time// Robot sprayer does not need to deviate from pre-programmed position at any time // a strictly controlled environment	Car system needs to know at all times exactly where it is
	Car system needs to recognise what it sees
	Car system will need a range of sensors
Actions to be performed known in advance for programmed robot sprayer	Car system has to analyse/react to an input very quickly (and then adjust one or more of the three given outputs to alter car motion)
Programmed robot sprayer requires only limited sensing of environment if any // fewer inputs to monitor	Car system has to continuously monitor many external variables
Robot sprayer does limited processing	Car system has to perform very complex processing
Robot sprayer has a relatively simple program which is numerically controlled	Car system will need very powerful processors

Guidance Table 2: Processing, why, sources of input data, derived information
Source of data: Radar: **Processing:** (long range) radar returns/signals processed to obtain location information of every object over a 360 degree view Plotted on a two dimensional map (for further processing). Changes in position processed Trajectories of moving objects calculated. (long range) radar returns/signals

			processed to obtain speed of moving objects Speed of the car subtracted from the speed of object. **Derived information:** Precise fix on the location of every object Distance from objects Speed information from changes in position and time Speed information from (speed) radar Direction information from changes in position Trajectories of moving objects **Why?** To keep car at safe distance from other objects//to steer car safely To negotiate roundabouts/junctions **Processing:** Radar return/signal processed to obtain speed information of objects. Speed of the car subtracted from the speed of object. **Derived information:** A zero result indicates a stationary object, a non-zero result indicates a moving object. **Why?** The car must be able to distinguish moving objects from stationary objects, e.g. pedestrian from fence post **Processing:** (short-range) radar returns/signals Separation distance between car and object Closing speed on object **Why?** To avoid collision by applying brakes automatically To maintain safe separation distance from objects at sides of car **Source of data: Stereoscopic Camera (at front of car)**: **Processing:** Separate images processed to construct view of surrounding area in 3D Machine intelligence processing used to extract important features **Derived information:** Depth information Road edge Road centre Lane edges **Why?** To predict car's trajectory Keep car within its lane Keep car on safe overtaking course		

			Source of data: High resolution video camera (at front of car): **Processing:** Video frames processed and matched by comparison with a database of road signs **Derived information:** Particular road sign **Why?** Needed to observe highway code Needed to be aware of junctions, etc. **Source of data: Global Positioning Satellite receiver:** **Processing:** Satellite signals processed to obtain location and time information Comparison made with a stored representation of road system **Derived information:** Position of car relative to junctions, etc Speed of car **Why?** Needed to observe highway code Needed to be aware of junctions, etc	

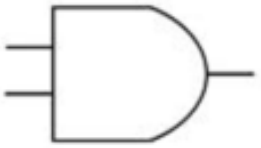
08	**1**		**Marks are for AO1 (understanding)** Solid-state memory chips are more robust; No reliance on mechanical parts that could fail; No corruption of data due to magnetic fields; Faster write speed so more data could be recorded; **Max 2**	MAX 2

08	**2**		**Marks are for AO2 (apply)** **1 mark:** 8000 * 2 * 360 ; **1 mark:** / 1000 ; **1 mark:** Final answer: 5760 (KB) ; **OR** **Alternative method:** **1 mark:** 8000 * 16 * 360 ; **1 mark:** / 8 **1 mark:** / 1000;	3

08	**3**		**Marks are for AO1 (understanding)** **1 mark:** Nyquist's theorem // sample rate should be twice the highest frequency to be stored; **1 mark:** With a sample rate of 8000 Hz any audio frequency over 4000 Hz would not be properly measured;	2

09	**1**		**Marks are for AO1 (knowledge)** **1 mark:** Table completed correctly; **1 mark:** AND gate symbol drawn;	2

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1



09	**2**		**Marks are for AO2 (apply)** A.B.(A + B) A.B.A + A.B.B ; [expansion of brackets] B.A + A.B ; [use of A.A = A] A.B ; [use of A + A = A] **1 mark:** Final answer: A.B; **Max 2 for working**	3

09	**3**		**Marks are for AO2 (apply)** (X + Y).(X + NOT Y) XX + X(NOT Y) + XY + Y(NOT Y) ; [expansion of brackets] X + X(NOT Y) + XY ; [use of X.X = X or use of Y(NOT Y) = 0] X (1 + NOT Y + Y) ; [use of 1 + X = 1] **1 mark:** Final answer - X; **Max 2** for working	3

10	**1**		**Mark is for AO1 (understanding)** Version: B;	1

10	**2**		**Marks are for AO1 (understanding)** A compiler produces object code whilst an interpreter does not; A compiler translates the whole of the source code into object code whilst an interpreter translates line by line; The object code produced by a compiler will execute faster, (once it is compiled) than interpreting the source code (every time the program is run) An interpreter can run (syntactically correct) parts of a program whilst there are syntax errors in other parts of it, which a compiler cannot; **Max 2**	MAX 2

10	**3**		**Marks are for AO1 (understanding)** Intermediate code is not (directly) executable // Intermediate code will by run/interpreted by a virtual machine // Compiled into an executable just before running/just in time; Intermediate code can be run on different computing platforms // One solution can be targeted at multiple platforms; **Max 2**	2