OCR
Oxford Cambridge and RSA

GCE

Computing

Unit **F453:** Advanced Computing Theory

Advanced GCE

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Annotation	Meaning
^	Omission mark
BOD	Benefit of the doubt
C	Subordinate clause / consequential error
	Incorrect point
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	No benefit of doubt given
P	Point being made
REP	Repeat
SEEN	Seen
	Correct point
TV	Too vague
0	Zero (big)
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.

NB Examiners should use the above annotations to assist them in deciding their marks. They do not, however, have to use them to annotate every instance seen.

Here are the subject specific instructions for this question paper

Award **one** mark per valid statement to maximum for the section unless stated otherwise.

Here is the mark scheme for this question paper.

Question	Answer/Indicative content	Mark	Guidance
Q 1 a (i)	• First Come First Served • Round Robin • Shortest Job First • Shortest Remaining Time • Multilevel Feedback Queues	**[3]**	Accept any other **processor** scheduling algorithm.
(ii)	• To make the most efficient use of the processor/resources • Be fair to all users/applications • Provide a reasonable response time • Prevent processes from failing to run/Process starvation/Deadlock	**[3]**	
b (i)	• Parts of a program divided into equal size pieces • Uses physical divisions	**[2]**	
(ii)	• Parts of a program divided into unequal sizes • Uses logical divisions	**[2]**	
(iii)	• Both ways of partitioning/splitting up memory • Use virtual memory/backing store to swap parts of programs • Allow programs larger than memory to run/insufficient memory • Allows programs to be stored in memory non-contiguously	**[2]**	**Virtual Memory/Backing store not enough on its own.**

Question	Answer/Indicative content	Mark	Guidance
Q 2 a	• Coding in binary would take a long time/be hard to find errors • Machine code is for a specific architecture • High level language has error diagnostics • High level language has library routines • Writing in a high level language is easier to code • High level code requires fewer lines to perform simple tasks.	[4]	**Allow for opposites** **For 2nd bullet – 'systems' is too vague.**
b	• Can be used in a virtual machine • Portable/ can be used on any machine • Protects the source code from being copied	[3]	
c	• Pre-tested • Saves time/ready for use/pre-written • Written by an expert • Written in a different language	[4]	**Allow error free as BOD instead of pre-tested**

Question	Answer/Indicative content	Mark	Guidance
Q 3 a	• Fetch- The next instruction is fetched from main memory**/**address • Decode- The instruction is interpreted/translated/split into opcode and operand (in the CIR) • Execute- The appropriate instruction/opcode is carried out on the operand.	[3]	**Fetch they may describe the whole cycle** **Not translated in MDR**
b	• Program Counter • Memory Address Register • Memory Data register • Accumulator • Index register • Interrupt register	[2]	cao accept: Memory Buffer Register
c	• CISC is more complex/RISC is simpler/CISC longer instruction set • RISC requires more RAM • CISC many address modes • CISC may have more registers • RISC takes one machine cycle/CISC takes many cycles to complete one instruction • RISC fixed number of bytes/CISC variable number	[4]	**Do not accept "task" in place of "instruction".**

Question	Answer/Indicative content	Mark	Guidance
Q 4 a (i)	• 1.75 Converted to binary 1.11 • Move decimal point 0.111 • Exponent is 001 • Correct answer 0111001	[4]	
(ii)	• Exponent 111 =000 + 1 = -1 • 0110 move decimal point = 0.011 • Convert to decimal/ fraction 0.375/ $^3/_8$	[3]	Accept other methods
b	• The larger the mantissa… • …the more accurate the number • The larger the exponent… • ….the greater the range	[4]	Allow opposites
Q 5 a	• Efficient use of memory • Can change size during execution/processing/running • Harder to program • Overflow/Underflow may cause an error • May be time consuming to search	[4]	
b (i)	• Data is not in any order/binary search needs an ordered set of data • Data set is too small to warrant binary search	[2]	
(ii)	• Compare 42 (first item) to be searched with 27 • Compare 83 (second value) and discard • Compare 27 (third value) • Display result/search stops	[4]	

<table>
<tr><th>Question</th><th>Answer/Indicative content</th><th>Mark</th><th>Guidance</th></tr>
<tr>
<td>(iii)</td>
<td>

List of numbers correctly built up
1 mark for new pivot/pointer
1 mark per move (max 3)

<table>
<tr><td>↓</td><td></td><td></td><td></td><td>↓</td><td></td></tr>
<tr><td>42</td><td>83</td><td>27</td><td>18</td><td>52</td><td>Stays the same</td></tr>
<tr><td></td><td>↓</td><td></td><td></td><td>↓</td><td></td></tr>
<tr><td>42</td><td>83</td><td>27</td><td>18</td><td>52</td><td>83 moves</td></tr>
<tr><td></td><td>↓</td><td></td><td>↓</td><td></td><td></td></tr>
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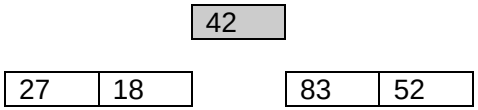
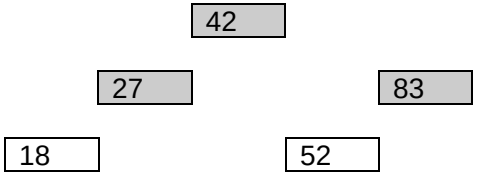
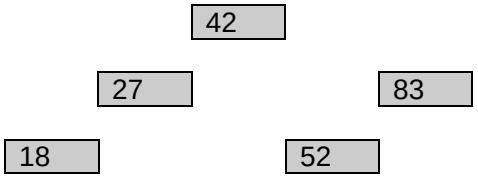
<tr><td>42</td><td>27</td><td>18</td><td>52</td><td>83</td><td>New pivot (18)</td></tr>
<tr><td>↓</td><td>↓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>27</td><td>18</td><td>42</td><td>52</td><td>83</td><td>42 moves</td></tr>
<tr><td>↓</td><td>↓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>18</td><td>27</td><td>42</td><td>52</td><td>83</td><td>27 moves</td></tr>
</table>
</td>
<td>[5]</td>
<td>
Answer may vary depending on pivots chosen
Alternate answer below:

Pick a number as the pivot. [1]
Create two sub lists of those elements greater and those less than the pivot. [1]
Without attempting to order within the sub lists. [1]
Repeat until all sub lists are 1 item large [1]
The elements assembled as a sorted list. [1]

Example Below (Candidates may choose any elements as pivots)
STEP ONE


STEP TWO


STEP THREE (Optional)


STEP FOUR


</td>
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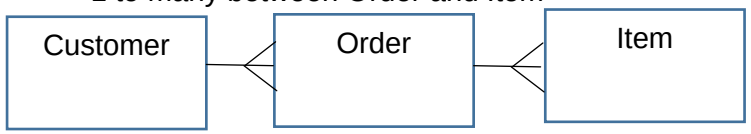
Question	Answer/Indicative content	Mark	Guidance
Q 6 a	• Class • Attribute/property • Method/operation	[3]	**cao**
b	• Object	[1]	
c	• A method of capturing/visualising/documenting (a system)… • Provides notation/diagrams… • …that many different people can understand • Designed for Object –Oriented systems	[4]	**"Easier to understand" is not enough for a mark.**
Q 7 a	• Fact • Rule • Goal • Instantiation	[4]	
b	• Step12 A solution is P=seat_belt Q=key… • …Step13 attempt to solve (P)… • …Step14 finds P=hand_brake • After finding/not finding a solution to a goal • go back and follow an alternative path • to find another solution	[6]	

Question	Answer/Indicative content	Mark	Guidance
Q 8 a	• Breaking down a problem… • …into smaller tasks… • …and then even smaller tasks… • …until a programmable solution is found • Uses a diagram to illustrate answer… • …showing task and sub-tasks	[6]	**Diagram needs to be some form of top-down/stepwise refinement.** **Wage(s) must be defined at the top of the structure for bullet 5**
b	• Eliminates the need for brackets/unambiguous • The same way that a processor would do it • Stacks are used	[3]	**Not computer**
c	• Global variables are (usually) defined at the start of a program • Global variables can be seen/used everywhere in the program • Local variables can only be seen/used in a procedure/function/sub routine in which they are declared • Local variables cease to exist once the procedure/function/sub routine they are in is finished • Local variables with the same name as global variables… • …will overwrite/take precedence over the values in the global variable • Local variables within two different procedures will not interfere with one another	[6]	**For 4th bullet accept construct**

Question	Answer/Indicative content	Mark	Guidance
9 a	**Mark band 6-8. High level response.** Candidate has given a comprehensive response stating **most** of the bullets for all three points and has used appropriate technical language throughout their answer. There are few, if any, spelling or grammatical errors. **Mark band 3-5. Medium level response.** Candidate has given an adequate response stating **some** of the bullets for all three points or has explained two comprehensively. The candidate has used some appropriate technical language in their answer. There may be a few spelling or grammatical errors. **Mark band 0-2. Low level response.** Candidate has given an adequate response stating some of the bullets for two points or has explained one comprehensively. The candidate may have used some appropriate technical language in their answer. There are some spelling or grammatical errors.	[8]	accept: Memory Buffer Register

Question	Answer/Indicative content	Mark	Guidance
	• Registers ○ Mentions CIR MDR MAR PC and ACC ○ Jump instruction CIR sends **address** to PC ○ PC incremented ○ MDR **copies** data to CIR ○ CIR holds the data to be decoded.. ○ …into opcode and operand • Saving ○ CIR sends address to MAR.. ○ …sends data to MDR ○ All data to be saved uses the ACC • Other relevant points ○ All arithmetic and logical operations use the ACC ○ Mention of buses (Address Data or Control) ○ Control unit for synchronisation ○ Mention of Interrupt Register ○ ALU performs calculations		
b	• Defines a variable/identifier… • …that has not been given an absolute address… • Absolute address may be used by other programs/functions • Address will be given on assembly/execution of the program • Makes the program easier to understand	**[4]**	

Question	Answer/Indicative content	Mark	Guidance
10 a	Flat file • May have redundant data • Flat file harder to update • No specialist knowledge needed to operate Relational database • Data Integrity • Linked tables • Easier to change format • Provides security features	**[4]**	Allow for opposites eg RD has no repeated data. Only one mark per bullet**.**
b	• Correct names • 1 to many between Customer and Order • 1 to many between Order and Item 	**[3]**	**CAO**
c	• Lists the **attributes** Title, First_Name, Surname and Phone_No… • … from the **table** Cust_File • … where **Age** is greater than 21 • … puts it in **ascending** order by Surname	**[4]**	**Description of each** **Not alphabetical**
d (i)	• Age	**[1]**	
(ii)	• Secondary key may not be unique • Used for sorting/searching data	**[2]**	
(iii)	• SELECT (Title, First_Name, Surname, Email_Address) FROM Cust_File • WHERE Age >= 15 • AND Age =< 18	**[3]**	Allow Phone_No instead of Email_Address or both no other attributes 1 mark per bullet No ORDER by needed ignore if there Age >14 AND Age <19 is allowed BETWEEN 15 AND 18 is allowed for 2 marks.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

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