OCR
Oxford Cambridge and RSA

GCE

Computing

Unit **F453:** Advanced Computing Theory

Advanced GCE

Mark Scheme for June 2015

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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
	Slash / half-mark
	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.

Question			Answer	Mark	Guidance
1	a		• Map of where files are (stored)… • …in backing store/hard disk • Stores/holds/contains addresses/pointers to start of files • Stores/holds/contains file names/file sizes/access rights • Identifies free space • Operating system updates FAT when files are accessed/saved/deleted	6	Accept • The cluster number of the next cluster in a chain • A flag to indicate last cluster/ A flag to indicate a bad cluster/ A flag to indicate a reserved cluster/ A flag to indicate an empty cluster
	b		• Boot file • User/personal settings	2	Accept Boot strap
	c	i	• Signal to processor to request/obtain processing time	1	
		ii	• Stack/LIFO • To store the contents of registers • To return values to registers • so processing can resume after interrupt has been processed	4	
2	a		**Mark band 6-8. High level response.** Candidate has described all 3 terms highlighting the differences between machine code and assembly language. Candidate has used appropriate technical terminology throughout. There are few, if any, spelling errors or grammatical errors. **Mark band 3-5. Medium level response.** Candidate has described two terms adequately. Candidate has used some technical terminology in the response. There may be spelling errors or grammatical errors, but they are not obtrusive.	8	

Question			Answer	Mark	Guidance
			Mark band 0-2. Low level response. Candidate has listed some relevant points but failed to give any detail. There is a lack of cohesion in the response. Candidate has failed to use correct technical terms in the response. Spelling and grammatical errors affect the readability of the response. *Machine code:* • Binary notation • Instructions operate on bytes of data • Dependent on architecture • Harder to program *Assembly language:* • Low level language… • …but higher level than machine code/mnemonics/hexadecimal • Uses mnemonics • Machine-specific/close to computer • Each instruction generally translated to 1 machine code instruction *Assembler tasks:* • Reserves storage for instructions & data • Replaces mnemonic opcodes by machine codes • Replaces symbolic addresses by numeric addresses • Creates symbol table • Checks syntax • Error diagnostics		Nothing about lexical analysis or code generation

Question			Answer	Mark	Guidance
	b		2 Marks from this section • Statements/tokens are checked… • …against the rules/grammar of the language • valid example given 3 Marks from this section • Errors reported as a list • Error diagnostics given • Detail added to symbol table… • …eg data type/scope/address • Receives output from lexical analysis/passes code to code generation	5	No syntax check
3	a	i	• Single control unit • One instruction at a time • Uses fetch execute **cycle** • Program & data stored together/program & data in same format	3	Accept single ALU Allow FDE Location TV
		ii	• Single Instruction Multiple Data (SIMD) • Allows same instruction to operate simultaneously on multiple data locations/many ALU's	2	
		iii	*Advantage* • Simpler operating system/easier to program *Disadvantage* • Slower than array processing on large sets of data	2	Disadvantage must be a comparison to an array processor Accept SIMD for array processing
	b	i	• Allow fast access to data which is needed frequently/for a specific purpose • Faster than <u>accessing</u> RAM/data bus/primary memory	2	Just fast access/faster TV
		ii	• Program Counter increments… • …during f-e cycle • A jump instruction from the Current Instruction Register/operand… • … program Counter changes to address given	4	Accept PC Accept CIR

Question			Answer	Mark	Guidance
4	a	i	• Exponent 011 = 3 • Mantissa 0.1100, move point 3 places right becomes 0110. • Denary value is 6	3	Accept alternative methods
		ii	• Exponent 111 = -1 • Mantissa 1.0100, move point 1 place left becomes 1.101 • Denary value is -3/8 = -0.375	3	Accept alternative methods Accept either fraction or decimal value
	b		• Pure binary 11.1 so mantissa 0.1110 • Point moved 2 places so exponent 010 • 01110 010	3	
	c	i	• 2	1	
		ii	• 2	1	
		iii	• Larger mantissa increases accuracy • Smaller exponent decreases range • X = 64 • Y = 1.75	4	Allow opposites.
5	a		• if queue full… • …return error & stop • else insert item at rear pointer position… • & increment rear pointer	4	Rear pointer indicating first free space in queue – accept alternative with rear pointer indicating final item & increment before insertion
	b	i	• One item at a time/serially… • …moved into correct position… • …until all items in list checked	3	Do not allow swap(ped) or pivots Allow two lists. • One item at a time taken from 1st list… • …and inserted into 2nd list… • …in the correct place.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>ii</td><td>eg
<table><tr><td colspan="5">List 1</td><td colspan="5">List 2</td></tr><tr><td>12</td><td>7</td><td>4</td><td>5</td><td>26</td><td>12</td><td></td><td></td><td></td><td></td></tr><tr><td>12</td><td>7</td><td>4</td><td>5</td><td>26</td><td>12</td><td>7</td><td></td><td></td><td></td></tr><tr><td>12</td><td>7</td><td>4</td><td>5</td><td>26</td><td>12</td><td>7</td><td>4</td><td></td><td></td></tr><tr><td>12</td><td>7</td><td>4</td><td>5</td><td>26</td><td>12</td><td>7</td><td>5</td><td>4</td><td></td></tr><tr><td>12</td><td>7</td><td>4</td><td>5</td><td>26</td><td>26</td><td>12</td><td>7</td><td>5</td><td>4</td></tr></table>
1 mark per correct row after row 1 in sequence to max 4</td><td>4</td><td>Method must be demonstrated somehow – circles, underlining, description e.g. “insert 12” etc
Must be an insertion sort

Do not allow swap(ped) or pivots</td></tr>
<tr><td></td><td></td><td>iii</td><td>• Less efficient/takes longer for large sets of data</td><td>1</td><td></td></tr>
<tr><td>6</td><td>a</td><td>i</td><td>• Declarative</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>eg
Use:
• Medical diagnosis
• Expert systems
Reason:
• Answer to one question affects the next question/Can find alternative solutions</td><td>2</td><td>Max one mark for use and max one mark for reason.
Accept other example uses with reasons</td></tr>
<tr><td></td><td>b</td><td></td><td>• Self-contained object/ (instance of a) class/entity/real world object …
• …contains routines/methods/attributes/data
• Program split into small units/object…
• …which are used (by other objects) to build a complex system
• Uses encapsulation…
• …to hide data within objects/object only accessed through methods
• Inheritance…
• …/superclass/subclass/derived classes</td><td>6</td><td>Marks in pairs, max 3 pairs</td></tr>
</table>

Question			Answer	Mark	Guidance
7	a	i	• Defined within one module… • …accessible only in that module/Any mention of scope • Can be used as parameters • Data is lost at end of module • Same variable name can be used in other modules without overwriting values/causing errors • Can overwrite global variables (with the same name)	4	For module allow procedure/function/sub routine/block of code
		ii	• Defined at start of program • Exists throughout program / in all modules • Allows data to be shared by modules	2	
	b	i	• Includes w / w not defined • Ends bc but only one lower allowed	2	
		ii	• not valid… • …needs minimum of 2 digits	2	
8	a		• <u>Temporary</u> storage • for data being processed/during calculations • I/O in processor… • …used as a buffer/gateway	4	
	b	i	• Part of the instruction/code • Indicates what to do	2	
		ii	• Sequence of letters • Easy for a person to remember *Example*: • ADD for addition	3	Accept other relevant examples
9	a		*e.g.* • NoInStock… • …to check stock levels/allow re-ordering • Location (in warehouse)… • …to find item when needed	2	Marks for single example with reason only Accept other relevant examples

Question			Answer	Mark	Guidance
	b	i	• Unique identifier • ProductId identifies a product / OrderId identifies an order	2	
		ii	• Primary key from one table used as an attribute in another table • to link tables/represent relationship • ProductId (is foreign key) in ORDER… • …to show which product has been ordered	4	
	c		• Only one product can be on an order • Customer would have to make a separate order for each product required	2	
	d		• Lists **attributes** Surname, Title, PhoneNo • from the **table** CUSTOMER • for all customers in Coventry • in **ascending** order of Surname • e.g. for local promotions/new store opening	5	Accept other relevant purposes Allow A – Z / alphabetical
10	a	i	*Process is*: Customer requests a refund Assistant requests help (from supervisor) Supervisor checks price POS terminal displays price Supervisor gives cash refund (to customer) *Marks for*: • At least 3 steps listed • 4 Steps listed • All steps listed in correct order	3	
		ii	eg • Check customer receipt / purchase date / price paid • Print new receipt / refund slip • Update store accounts	2	Accept other relevant examples

Question			Answer	Mark	Guidance
	b	i	• Represents object of class DoorLock… • … anonymous	2	
		ii	• (Vertical) dotted lines • Top to bottom in time order/sequence of events • Lifelines are either infinite or finite • Shows when active/inactive • Rectangles on the lifelines show methods	4	

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