OCR
RECOGNISING ACHIEVEMENT

GCE

Computing

Advanced GCE

Unit **F453:** Advanced Computing Theory

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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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 doubt
C	Subordinate clause/Consequential error
Cross	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
/	Slash
Tick	Tick
TV	Too vague
ZERO	Zero (big)

Question			Answer	Marks	Guidance
1	(a)	(i)	• Spooling.	1	
		(ii)	**Three** from: • Allow sharing (on a network/different users) • Avoids delays/frees processor • Avoids speed mismatch/printers are slow/allows jobs to be printed at another time • Allows jobs to be prioritised	3	
	(b)		**Two** from each: <u>Utility</u> • Maintenance program/carries out housekeeping • Eg, virus checker. <u>Data security</u> • Use of passwords • Access rights • Encryption. <u>Memory management</u> • Partitioning • Protect processes from each other/allocates memory • Virtual memory/paging/segmentation.	6	Accept hardware drivers Accept 'hiding data', 'restricting data' as a description of access rights Accept reference to 'automatic back-ups'

Question			Answer	Marks	Guidance
2	(a)		<table><tr><th></th><th>Lexical analysis only</th><th>Syntax analysis only</th><th>Both</th><th>Neither</th><th>Lexical & syntax analysis</th></tr><tr><td>This is part of compilation</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>May discover errors</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Removes redundant code such as comments</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Translates into source code</td><td></td><td></td><td></td><td>✓</td><td></td></tr><tr><td>The symbol table is used</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Optimises code</td><td></td><td></td><td></td><td>✓</td><td></td></tr></table>	6	1 mark per correct row
	(b)		**Three** from: • Created during lexical analysis • Used for reserved words/keywords • Each token is a string of binary digits… • … of fixed length.	3	Accept 'they are 16 bit' as inferring last two bullets
3	(a)		• Uses fetch execute cycle/one instruction at a time (in sequence) • Single control unit/processor manages program control • Program & data stored together/in same format.	3	

Question			Answer	Marks	Guidance
	(b)	(i)	**Two** from: • Location in the processor • Used for a particular purpose • Temporarily stores data/control information • Allows very high speed access.	2	
		(ii)	**Five** from: • Contains the instruction to be executed • Splits instruction into component parts • Holds opcode while it is decoded • Sends the address to the MAR for accessing data/value to accumulator • Sends address to PC for jump instruction • Determines the type of addressing to be used.	5	
4	(a)	(i)	• Exponent 100 = -4 • Mantissa 0.10, move point 4 places left becomes 0.00001 • Denary value is 1/32 or 0.03125.	3	Accept alternative methods Accept either fraction or decimal value cao = 1 mark Follow through from incorrect exponent
		(ii)	• Maximum value is 011011 • Exponent is 3, • Mantissa 0.11, move point 3 places right becomes 0110 = +6 • Maximum value is +6 so +16 can't be represented. *Or* • +16 pure binary is 010000 • Mantissa is 0.10 • Point moves 5 places so exponent is +5 or 0101 … • …which cannot be written in 3 bit twos complement.	4	Other, equivalent, methods of explanation are acceptable
	(b)		• 8-bit mantissa values are more accurate than 4-bit mantissa • 4-bit exponent gives smaller range of values than 8-bit exponent.	2	
5		(i)	• Stack.	1	cao

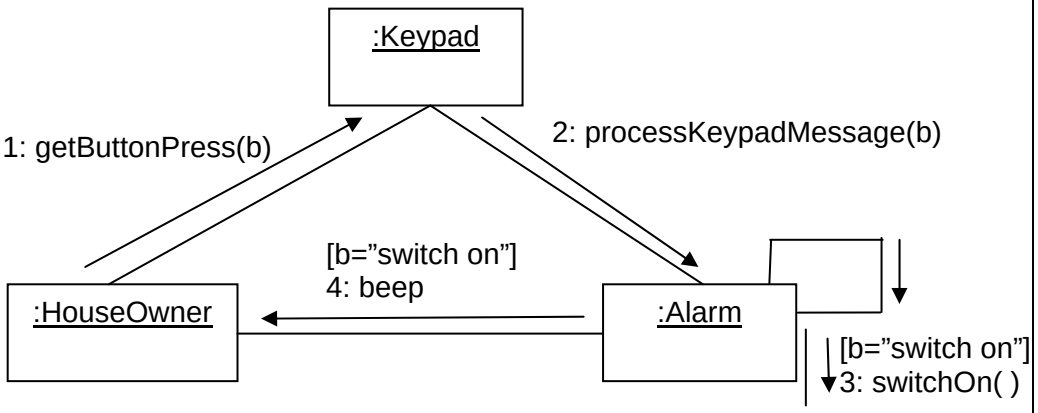
Question			Answer	Marks	Guidance
		(ii)	• If stack is empty… • …report error & stop • Output data(top) • Decrement top.	4	
		(iii)	• Overflow.	1	
		(iv)	**One** from: • Storing return addresses (during subroutine) • Passing parameters • Storing contents of registers while processing interrupt. • Reversing the order of a set of data	1	
6	(a)	(i)	**Three** from: • Program consists of declarations/statements or facts/rules • States what is required… • …but not how to do it • Statements do not have to be in a specific order.	3	Accept 'goals'
		(ii)	**Three** from: • Imperative language • Statements in blocks… • …called procedures & functions • Program states what to do & how to do it • Statements are in a specific order.	3	
	(b)	(i)	• Set tasks to be completed in a specific way.	1	
		(ii)	• Expert system/answer to a question affects next question.	1	Allow knowledge based/artificial intelligence
7	(a)	(i)	• To define terms unambiguously in a computer language.	1	

Question			Answer	Marks	Guidance
		(ii)	*1223:* • Series of digits, apply recursive rule for value **value** *4 + 7:* • <digit> + <digit> **sum** *D + 2:* • <letter> + <digit> **not defined** *EF:* • <letter> <letter> **not defined** *A + B:* • <letter> + <letter> **not defined**	5	
		(iii)	*eg <hex> ::= <digit> | <letter> | <hex><digit> | <hex><letter>* *Marks for:* • Correct notation throughout • <digit> | <letter> • Recursive definition with digit • Recursive definition with letter.	4	
	(b)		value  *Marks for* • Diagram defines value to be a single digit • Diagram defines value to be multiple digits	2	
8	(a)	(i)	**Two** from: • Close to design of processor • Can access memory locations directly • The processor in the washing machine has a limited memory.	2	

Question			Answer	Marks	Guidance
		(ii)	**Two** from: • Reflects type of problem/problem-oriented • Allows use of mathematical functions • Portability • Uses library routines • Complexity of problem • Easy to maintain	2	Accept closer to human language
	(b)		**Two** from: • A code that is easily remembered • Used to stand for opcode/command • The operation part of the instruction • Replaced by binary code (during assembly) **Example** SUB.	3	1 for example, plus any other 2
	(c)		• Uses address field as a vector/pointer… • …to address to be used • Increases the size of the address that can be used… • ….allowing a wider range of memory locations to be accessed	4	Accept diagram for first two mark points
	(d)		**Four** from: • Allows real address to be calculated by adding a base address… • …to the operand • Relative address is an offset • Can be used for arrays/branching.	4	1 mark must be for the purpose Accept other correct purposes
9	(a)	(i)	• PRIMARY KEY MemberId)	1	cao
		(ii)	**Two** from: • LINE 5 • Incorrect data type/PhoneNumber is not an integer • PhoneNumber VARCHAR(11),	2	Accept *Line 4:* Maximum 8 characters not enough Forename VARCHAR(18) Accept PhoneNumber CHAR(11)

Question			Answer	Marks	Guidance
	(b)	**(i)**	**Two** from: • Diagram shows one-many relationship/diagram should be many to many • Session has only one member in diagram • Groups of members can attend sessions.	2	
		(ii)	 *Marks for:* • Link entity with meaningful name • One-many from MEMBER to link entity • Many-one from link to SESSION.	3	
	(c)	**(i)**	**Two** from: • Provide access to relevant data… • …for a routine task • …without the need to write code • Can restrict access to (confidential) data.	2	
		(ii)	**Two** from each: *Instructor:* • So that the instructor does not have to devise search criteria • Tasks that will be needed are predictable • Reduces the chances of errors being made • So that the instructor is only able to see the member details that are relevant *Member:* • Easy for inexperienced user • Read only/prevents changes • Ensures privacy/restricts access to other data.	2 2	

Question			Answer	Marks	Guidance
10	(a)		**Three** from: • Allows systems analysts, programmers & clients to communicate • Provides a standard way to present information… • …about a system/algorithm design • Provides visual information… • …so is easy to understand • Allows easier system maintenance/modification.	3	
	(b)	1	• Object diagram • (Anonymous) object… • …of class Name1.	2	
		2	• Lifeline • Top to bottom in time order/shows duration of the object	2	Accept ‘timeline’
		3	• Activation • Execution of operation by object.	2	
		4	• Message… • …from object in class Name1 to object in class Name2.	2	Accept ‘between the objects’
	(c)		• State diagram.	1	

Question	Answer	Marks	Guidance
(d)	 *Marks for:* • Numbered sequence • 2 or more correct labels • 2 or more correct arrows • Loop on Alarm • [b="switch on"] • Correct notation used	6	

Question			Answer	Marks	Guidance
11			**Mark band 6–8. High level response.** Part A: Candidate has correctly explained both of the terms. Part B: Candidate has given an advantage and a disadvantage of each.. Part C: Candidate has used the example set to illustrate their answer. 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 included at least 2 of parts A, B, C above. Candidate has used some technical terminology in the response. There may be spelling errors or grammatical errors, but they are not obtrusive. **Mark band 0–2. Low level response.** Candidate has listed some relevant points but failed to explain the terms or make comparisons in any detail. Candidate may have attempted part or all of a sort without explanation. 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. *Points may include:* *Insertion sort:* • Insert one number at a time into correct position… • …so list of sorted numbers is built up *Insertion sort on set of numbers given:* • Insert 25 into new file: 25, 7, 48, 19, 32, 21 • Insert 7: 7, 25, 48, 19, 32, 21 • Insert 19: 7, 19, 25, 48, 32, 21 • Insert 48: 7, 19, 25, 48, 32, 21 • Insert 32: 7, 19, 25, 32, 48, 21 • Insert 21: 7, 19, 21, 25, 32, 48 – sort complete.	8	

Question			Answer	Marks	Guidance
			Advantage: • Simplest sort algorithm. *Disadvantage*: • Inefficient for large sets of data. *Quick sort:* • Uses two pointers • Compare numbers at pointers & swap if in wrong order • Move one pointer at a time • Alternative method uses a pivot • Repeated splitting into sublists • Sublists are independent so can be sorted separately using a recursive algorithm • Sublists are reduced to a single number then put together to form sorted list. *Advantage:* • Very quick for large sets of data. *Disadvantage:* • Initial arrangement of data affects the time taken. • Harder to code		
			Total	**120**	

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

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553