OCR
RECOGNISING ACHIEVEMENT

GCE

Computing

Advanced GCE **F453**

Advanced Computing Theory

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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1 mark per bullet point, to maximum stated, unless indicated otherwise.

Question			Expected Answer	Mark	Rationale/Additional Guidance
1	(a)	(i)	• to allocate memory to allow separate processes to run at the same time • to deal with allocation when paging/segmentation • to reallocate memory when necessary • to protect processes/data from each other • to protect the operating system/provide security • to enable memory to be shared	**[Max 2]**	
1	(a)	(ii)	to allow programs to run that need more memory than is available	**[1]**	
1	(a)	(iii)	• use of backing store as if it were main memory/temporary storage • paging/fixed size units • swap pages between memory & backing store… • …to make space for pages needed	**[Max 3]**	
1	(a)	(iv)	• occurs when using virtual memory/moving pages between memory & disk • disk is relatively slow • high rate of disk access • more time spent transferring pages than on processing	**[Max 3]**	
1	(b)		Examples include: • round robin • each user allocated a short period of time/in a sequence *or* • system of priorities • highest priority first *or* • length of job • shortest job first *or* • first come, first served • jobs processed in order of arrival	**[Max 2]**	Answers in pairs

Question			Expected Answer	Mark	Rationale/Additional Guidance
2	(a)		• convert from source code… • …to object code • detect errors in source code	[Max 2]	
2	(b)	(i)	• can run on a variety of computers • same intermediate code can be obtained from different high level languages • improves portability	[Max 2]	
2	(b)	(ii)	interpreter / virtual machine	[1]	
2	(b)	(iii)	the program runs more slowly/has to be translated each time it is run / need additional software	[1]	
2	(c)		• makes code as efficient as possible • increases processing speed • reduces number of instructions	[Max 2]	
3	(a)		• single control unit/processor (manages program control) • program stored with data… in the same format… • one instruction at a time	[Max 2]	
3	(b)		*(do **not** accept abbreviations)* • memory address register • memory data register • current instruction register • accumulator • interrupt register • index register	[Max 3]	
3	(c)	(i)	• PC holds address of next instruction • copy contents of PC to MAR • increment PC • load instruction pointed to by the MAR to MDR • copy instruction from MDR to CIR • decode instruction in CIR	[Max 4]	

Question			Expected Answer	Mark	Rationale/Additional Guidance
3	(c)	(ii)	• by changing contents of PC (to address part of instruction) • copy address part of instruction… • … in CIR to PC	[2]	
3	(d)		• an additional processor • …used for a specific task • improves processing speed by executing concurrently • eg maths co-processor/floating point accelerator	[Max 3]	
4	(a)		• exponent 01 represents 1 • mantissa 0.10110, move point 1 place right so becomes 01.0110 • value is 1.375 *or* • exponent 01 represents 1 • mantissa 0.10110 represents 11/16 or 0.6875 • value is 11/16 multiplied by 2^{1} = 11/8 = 1.375	[Max 3]	
4	(b)		*(value is 011111 01)* • (mantissa) 011111 • (exponent) 01	[2]	
4	(c)	(i)	number A, as first 2 bits are different/starts with 10	[1]	
4	(c)	(ii)	• to ensure unique representation of a number • to provide maximum precision/accuracy • multiplication is more accurate	[Max 2]	
4	(c)	(iii)	• value in binary 11.1 / 011.1 • mantissa is 0111 (move point 2 places left) • exponent is 0010 (for 2, fill with 0s to get 4 bits)	[Max 3]	

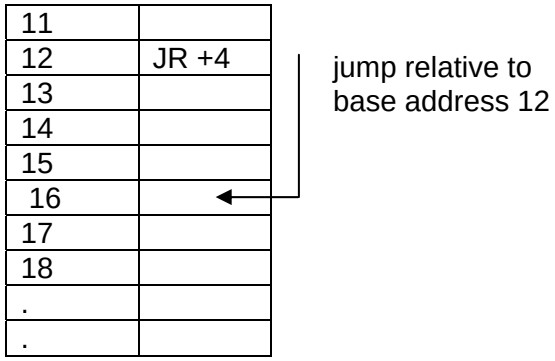
Question			Expected Answer	Mark	Rationale/Additional Guidance
5	(a)	(i)	size is fixed when structure is created/size cannot change during processing	[1]	
5	(a)	(ii)	amount of storage is known/easier to program	[1]	
5	(b)	(i)	(Anna, Billy, Cleo, Helen, Ian, Omar, Pritti, Rob, Tom) *marks for* • correct order • all names used once	[2]	
5	(b)	(ii)	*marks for* • open existing files • create new file • check existing files are not empty • use pointers/counters to identify records for comparison • repeat • compare records indicated by pointers • copy earlier value record to new file • move correct pointer • until end of one file • copy remaining records from other file • close files • assume common key • assume if 2 records are the same… • …only 1 is written to new file	[Max 6]	

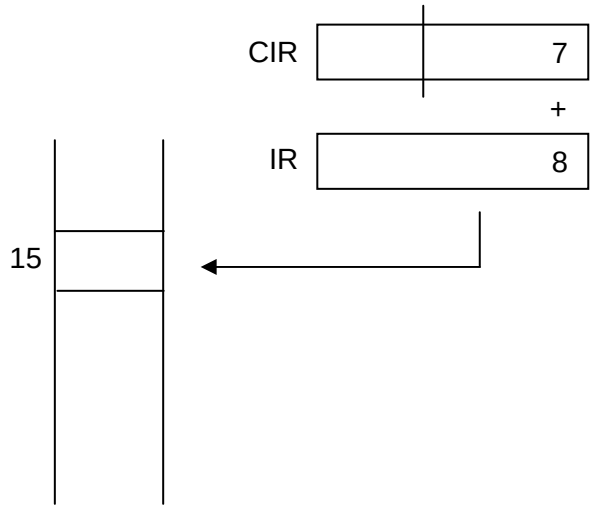
<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Rationale/Additional Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>Low-level</th><th>Object-oriented</th><th>Procedural</th></tr>
<tr><td>Data is only accessible through methods</td><td></td><td>✓</td><td></td></tr>
<tr><td>Each instruction usually represents one machine code instruction</td><td>✓</td><td></td><td></td></tr>
<tr><td>Inheritance may be used</td><td></td><td>✓</td><td></td></tr>
<tr><td>Local variables may be used</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>Mnemonics are used</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td>[1 mark per correct row, max 5]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(i)</td><td>declarative</td><td>[1]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(ii)</td><td>cat (tom)/cat (leo)/cat (snowy)/mouse (jerry)</td><td>[1]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(iii)</td><td>chases (A, B) if cat (A) and mouse (B)</td><td>[1]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(iv)</td><td>chases (X, Y) ?</td><td>[1]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(v)</td><td>set X = tom</td><td>[1]</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(vi)</td><td>• after finding a solution (to a goal)
• go back and follow an alternative path…
• …to attempt to find another solution
• (after step 6) step 7 is the same as step 1</td><td>[Max 3]</td><td></td></tr>
</table>

Question			Expected Answer	Mark	Rationale/Additional Guidance
7	(a)		• each module can be written as a functional procedure… • …which can be tested individually • library routines • code is reusable • main program consists of calls to functions/procedures… • …which may be nested	[Max 2]	

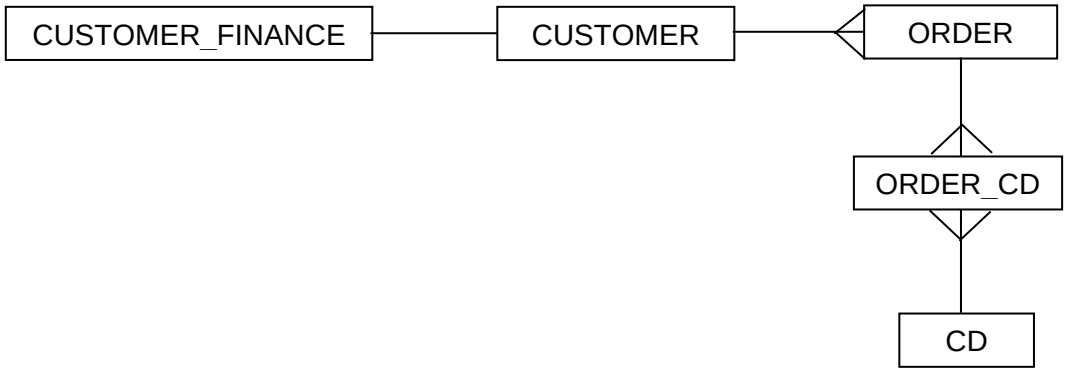
7	(b)		**Mark band 6-8, High level response** Candidate has discussed all 3 of the terms and made some comparisons between them. Candidate has used appropriate technical terminology throughout. There are few, if any, spelling errors or grammatical errors. **Mark band 3-5, Medium level response** Candidate has discussed all 3 of the terms, or discussed 2 of the terms and made some comparisons between them. 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 may have listed some relevant points but failed to explain the terms or make comparisons. There is 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 to be made:- *local variables*: • a variable defined within one part of program… • …& is only accessible in that part • data contained is lost when execution of that part of program is completed • the same variable names can be used in different modules *global variables*: • a variable that is defined at the start of a program… • & exists throughout program… • …including functions/procedures • allows data to be shared between modules • overridden by local variables with the same name *parameters*: • information about an item of data… • …supplied to a function or procedure • can be passed by reference or by value • used as a local variable		

7	**(c)**	**(i)**	stack	**[1]**	
7	**(c)**	**(ii)**	• so program can return correctly when procedure has been completed/store return address • allows data to be transferred	**[Max 1]**	
8	**(a)**		to unambiguously **define** the syntax of a computer language	**[1]**	
8	**(b)**	**(i)**	only 1 letter allowed/letter must be at start only	**[1]**	
8	**(b)**	**(ii)**	G is not defined (as a letter)	**[1]**	
8	**(c)**		e.g. < DIGITS> ::= <DIGIT> | < DIGIT> <DIGITS> < LETTERS > ::= < LETTER > | < LETTER > < LETTERS > <NEW_CODE> ::= < DIGITS> | < DIGITS> < LETTERS > • DIGITS defined correctly • LETTERS defined correctly • NEW_CODE defined correctly	**[Max 3]**	

Question			Expected Answer	Mark	Rationale/Additional Guidance
9	(a)		• a code that is easily remembered… • …used to give the opcode/instruction • e.g. ADD	[2]	
9	(b)		• allows a real address to be calculated… • …from a base address… • …by adding the relative address • relative address is an offset • can be used for arrays • can be used for branching accept labelled diagram eg:  	[Max 3]	

Question			Expected Answer	Mark	Rationale/Additional Guidance
9	(c)		• modifies the address given… • …by adding the number… • …from the index register • …to address in instruction accept labelled diagram eg:  	[Max 3]	
9	(d)		• immediate • direct • indirect	[Max 2]	
9	(e)		• the order in which instructions are executed • the order may be changed by a jump instruction/conditional jump instruction	[Max 2]	

Question			Expected Answer	Mark	Rationale/Additional Guidance
10	(a)		not unique/more than one CD with same composer	[1]	
10	(b)		• used to search for a group of records • eg CDs with same artiste *(accept any sensible example from the data given in question)*	[2]	
10	(c)	(i)	one-one	[1]	
10	(c)	(ii)	security/privacy/different access rights to sensitive data	[1]	
10	(c)	(iii)	• a customer may have multiple orders • separate storage avoids data duplication • avoids data inconsistency	[2]	
10	(c)	(iv)	many-many/not in 3rd Normal Form (3NF)	[1]	

Question			Expected Answer	Mark	Rationale/Additional Guidance
10	(c)	(v)			
			marks for • link entity with meaningful name, inserted between ORDER and CD • first correct relationship with link entity • second correct relationship with link entity	**[3]**	
10	(d)		• lists attributes CustomerId, AmountOwed, and CreditLimit… • …for all customers who owe more than £80… • …in order of CreditLimit from lowest to highest	**[Max 3]**	must clarify the order for 3rd bullet

Question			Expected Answer	Mark	Rationale/Additional Guidance
11	(a)		• a standard way to present (information)… • …the design of a system… • …which is visual, so easy to understand • allows systems analysts, programmers and clients to communicate • makes system maintenance easier… • …when modifying a system	**[Max 2]**	
11	(b)		• Figure 1 class diagram • Figure 2 object diagram • Figure 3 sequence diagram	**[3]**	
11	(c)		inheritance	**[1]**	
11	(d)	(i)	myAlarm	**[1]**	
11	(d)	(ii)	Sensor/PressureSensor/MotionSensor/Alarm/Person/ KeyPad	**[1]**	
11	(d)	(iii)	getButtonPress( )/processMessage( )/setAlarmOn ( )/lightOn( )	**[1]**	
			Total	**[120]**	

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