OCR
RECOGNISING ACHIEVEMENT

GCE

Computing

Advanced GCE

Unit **F453:** Advanced Computing Theory

Mark Scheme for January 2012

Oxford Cambridge and RSA Examinations

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

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Annotations

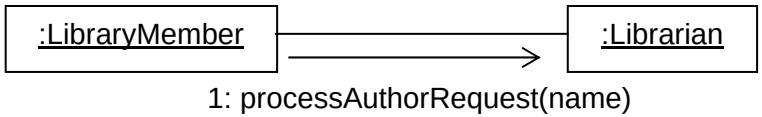
Annotation	Meaning
^	Omission mark
BOD	Benefit of doubt
C	Subordinate clause/Consequential error
Cross	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
/	Slash
Tick	Tick
TV	Too vague
ZERO	Zero (big)

Question			Answer	Marks	Guidance
1	(a)	(i)	• to alert the processor that a task needs attention/request processing time • power failure	2	accept "causes a break in execution" Marks are independent Allow hardware failure/clock as examples
		(ii)	• stack • LIFO • to store the contents of registers • to return values to registers… • …in order to resume processing	4	
		(iii)	• Interrupt register is checked… • when each cycle completed • by comparing priority of the current task with interrupt register	2	
	(b)	(i)	• eg printer out of paper	1	accept any valid example
		(ii)	• reset flag(s) to inactive state • check for further interrupts… • … & service them if necessary • restore contents of registers (from stack)	2	
	(c)		• file allocation table (1 mark) max 3 of the following: • addresses/pointers to/location of/ start of files/address of first cluster • file names • file sizes • access rights • free space	4	Accept: Date/time/last edited Accept: Links to further clusters

Question			Answer	Marks	Guidance
2	(a)	(i)	• assembly (language)	1	cao
		(ii)	• binary notation/executable form • set of all instructions available • (instructions operate on) bytes of data • dependent on architecture/processor design	3	
		(iii)	• reserves storage for instructions & data • replaces mnemonic opcodes by machine codes • replaces symbolic addresses by numeric addresses • creates symbol table… • …to match labels & addresses • checks syntax/gives error diagnostics	4	
	(b)		• to perform common tasks • they are error-free/have been tested • ready to use/saves work/saves time • may be used multiple times • may have been written in different source language • use other programmers' expertise	3	
3	(a)	(i)	• single control unit • one instruction at a time/in linear sequence • uses fetch (decode) execute cycle • program stored with data/program & data in same format	3	
		(ii)	• parallel processor • array processor • vector processing	2	Allow: • Reduced Instruction Set Computer • Complex Instruction Set Computer

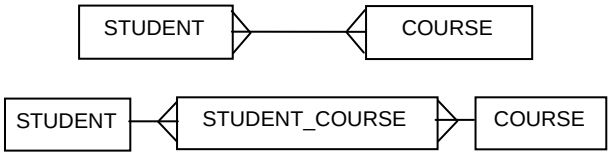
Question			Answer	Marks	Guidance
	(b)		• Instruction/data from address in MAR is copied to MDR • instruction in MDR is copied to CIR • MDR acts as a buffer/temporary store • MDR contains data/instruction… • …when being transferred between memory & processor	4	
	(c)		• holds data being processed • temporary storage of intermediate results (in the ALU) • is where calculations are performed • input & output data passes through	2	
4	(a)	(i)	• exponent 00100 represents 4 • mantissa 0.11, move point 4 places right so becomes 1100 • value is 12 *or* • exponent 00100 represents 4 • mantissa 0.11 represents $\frac{3}{4}$ or 0.75 • value is $\frac{3}{4}$ multiplied by 2^4 which is $\frac{3}{4}$ *16 = 12	3	
		(ii)	(answer is 010 11110) • pure binary 0.001 • move point 2 places right 0.1, mantissa is 0.10 • exponent is -2 • in 5 bits, +2 is 00010 • so -2 in 5 bits is 11110	4	Accept some alternative working, but a method must be shown. Correct answer with no working is max 2.

Question			Answer	Marks	Guidance
	(b)		• exponent 100 represents -4 • mantissa 0.1100, move point 4 places left so becomes 0.000011 • value is $\frac{1}{32} + \frac{1}{64} = \frac{3}{64} = 0.046875$ *or* • exponent 100 represents -4 • mantissa 0.11 represents $\frac{3}{4}$ or 0.75 • value is $\frac{3}{4}$ multiplied by 2^{-4} which is $\frac{3}{4} * \frac{1}{16} = \frac{3}{64}$	3	
	(c)		(answer is 010000 111100) • in mantissa, point moves 4 places to right • exponent becomes -4 • in 6 bits, +4 is 000100 • normalised, mantissa is 010000 • … and exponent is 111100	4	Accept some alternative working, but a method must be shown. Correct answer with no working is max 2.
5	(a)		• start at mid point 'Kendal' • 'Hull' is less than Kendal so take first half of list & discard the rest • repeated halving… • …until 'Hull' is found	3	
	(b)		*advantage*: • (usually) faster because… • …fewer items are checked/more efficient for large files *disadvantage*: • items must be in an order… • …to allow appropriate items to be discarded	4	

Question			Answer	Marks	Guidance
	(c)	(i)	• Adam, Ben, Charlie, George, Judi, Mic, Suzi, Yasmin	1	cao
		(ii)	• records have a common key • files each have records sorted into the same order	2	
	(d)	(i)	• first in, first out/FIFO/data items are added at one end & removed from the other • two pointers are required	2	Allow a diagrammatic answer Allow one pointer with length of queue
		(ii)	• Eg spool queue/jobs waiting for printer • job queue in batch processing system • Handling of jobs in a round robin system	2	
		(iii)	• check that queue is not already full	1	
		(iv)	• check that queue is not empty	1	
6	(a)		• activity diagram • transition • condition statements	3	
	(b)	(i)	• give information about instances of a class… • …& how they link (at specific times)	2	
		(ii)	• message/interaction… • …from one object to another *on diagram* • arrow… • with <u>appropriate</u> label eg  	4	number on label may be omitted

Question			Answer	Marks	Guidance
7	(a)	(i)	• procedures tested separately • easier to maintain program • main program is simpler/code is clearly structured • use of library routines to save time • code is reusable • program produced faster/to a higher standard… • …as procedures may be shared between programmers	3	
		(ii)	• problem broken into sections… • which become progressively smaller • until each section can be written as a single procedure/represents one step in the algorithm	3	
	(b)	(i)	• a variable defined at the start of a program • exists throughout program… • including functions & procedures • allows data to be shared by modules • overridden by local variables with same name • eg VAT rate	4	max 3 unless example given
		(ii)	• a variable defined within one module… • & only accessible in that module • data is lost when module is completed • same variable name may be used in different modules • eg loop counter	4	max 3 unless example given Allow: can overwrite global variable
8	(a)		• faster to access than Random Access Memory • used for specific purposes… • …which involve frequent access	3	

Question			Answer	Marks	Guidance
	(b)		• contains address of next (machine code) instruction to be executed • during fetch execute cycle.. • …contents of PC are copied to MAR • …PC is incremented • for a jump instruction, address from CIR is put into PC	5	Accept when an interrupt is to be processed, address of ISR is put into PC

Question			Answer	Marks	Guidance	
					Content	Levels of response
9	(a)		*Points to be made*: Normalisation • Relationship between STUDENT and COURSE is many-many. • Many-many relationships are not allowed. • The system described is not in 3NF • Normalisation resolves many-many relationships • An additional entity must be inserted between STUDENT and COURSE, and the relationships changed Primary key • STUDENT has a primary key (StudentId) which uniquely identifies each student • COURSE has a primary key (CourseId) which uniquely	8	*Diagrams*: 	**High level response (6–8):** Candidate has explained all 3 of the terms and related them to the example provided. Candidate has included a normalised correct E-R diagram. Candidate has used appropriate technical terminology throughout. There are few, if any, spelling errors or grammatical errors. **Medium level response (3–5):** Candidate has explained at least 2 of the terms or has explained one of the terms and has included a correct normalised E-R diagram. Candidate has used some technical terminology in the response. There may be spelling errors or grammatical errors but they are not obtrusive.

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
			identifies each course Foreign key • StudentId (CourseId) acts as a foreign key in the link entity… • …to provide the relationship between the link entity & STUDENT (COURSE) • StudentId & CourseId form a composite key… • …which is (part of) the primary key for the link entity			**Low level response (0–2):** Candidate may have listed some relevant points or has included a correct E-R diagram, but failed to explain the terms. 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.
	(b)	(i)	• Software that… • handles the complexities of managing a database • may provide a user interface • may use SQL to communicate with other programs • provides different views of the data for different users	4		Accept other valid points
		(ii)	• finds data • adds new data • updates data • maintains indexes • enforces data integrity rules • manages access rights	2		

Question			Answer	Marks	Guidance
10	(a)		• declarative • facts • rule • goal	4	cao
	(b)		• backtracking • (step 7) attempt to solve seal(P) • (step 8) finds P=splash • (step 9) set P= splash	4	cao

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