CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9691 COMPUTING

9691/31

Paper 3 (Written Paper), maximum raw mark 90

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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		GCE A LEVEL – May/June 2013	9691	31
(a) (i) Ma	any-to-many		[1]
(ii) E-	R diagram		
		DOCTOR Treats PATIENT		
				[1]
(iii)			
		DOCTOR- PATIENTS	PATIENT	
	Lir	nk table drawn		[1]
	2 >	one-to-many relationships		[1]
	pri	mary key in DOCTOR links to foreign key in link table		[1]
	pri	mary key in PATIENT links to foreign key in link table		[1]
	No	o mention of foreign key scores max 1 for final two points	S	
(b) (i) Or	ne to many		[1]
(ii) E-	R diagram		
		WARD Accomodates PATIENT		
				[1]
(c) T	he pri	imary key of table WARD - WardName		[1]
M	latche	es to WardName in the PATIENT table		[1]
		ys a 'list' of the ward <u>s</u> (names)		[1]
V	/hich	nber of wards has unoccupied beds available		[1]

Mark Scheme

Syllabus

Paper

Page 2

[Total: 12]

R. the condition explained using the attribute identifiers

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2 (a) Meta language

Rules // Grammar (which describe a high level programming language / protocol specification)

The <u>syntax</u> or <u>structure</u> of all program statements

[2]

(b) (i) A <u>rule</u> which is defined in terms of itself NB Not 'procedure' ...

[1]

(ii) Rule 3

[1]

(iii)

Expression	Valid / Invalid	Rules used		
0	Invalid	1,4	4, 2	[1 + 1]
"1"	Valid	4 then combination of 1,2 and 3	combination of 1,2 and 3, end with 4	[1 + 1]
"001"	Valid	4 then combination of 1,2 and 3 AND rule 3 used more than once	combination of 1,2 and 3 with rule 3 used more than once, ends with 4	[1 + 1 + 1]

(c) <Dollar> ::= \$

<BinaryString> ::= <Paren theses><Binary><Parentheses>

|<Parentheses><Dollar><Binary><Parentheses>

Note: credit alternative answers which use an intermediate expression

[2]

[Total: 13]

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3 (a) Direct addressing / LDD

[1]

(b) Indexed addressing / LDX

[1]

(c) Annotation to show 203 used as a forwarding address

[1]

Accumulator contains 38

[1]

(d)

	Memory location		
ACC	109	110	Output
19 (mus colur	the first ntry)	0	
20	20		
37			
38			
58		58 /ft	58 /ft

1 mark for each of the emboldened numbers in the correct column and sequence [MAX 5]

(e) Labels added to a (symbol) table // creates a list of addresses [1]

Labels are later looked up to determine the actual address / Assembler must allocate addresses to labels [1]

Mnemonic looked up to give binary code/machine code [1]

Macro instructions are expanded into a group of instructions [1]

The software makes two passes through the source program [1] [MAX 3]

[Total: 12]

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4 (a) (i) Dynamic data structure changes <u>size</u>... [1]

At execution time [1]

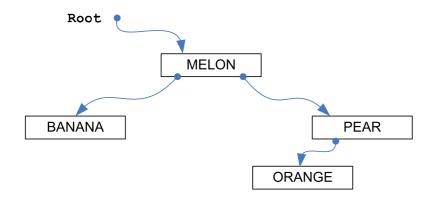
// A static data structure has a fixed <u>size</u> [1] [MAX 2]

(ii) Dynamic data structure matches size to data requirements [1]

Takes <u>memory</u> from heap as required //
returns <u>memory</u> as required (following node deletion) [1]

There is no wasted <u>memory</u> space / makes efficient use of <u>memory</u> [1] [MAX 1]

(b)



Root is MELON1 [1]

Correct left subtree [1]

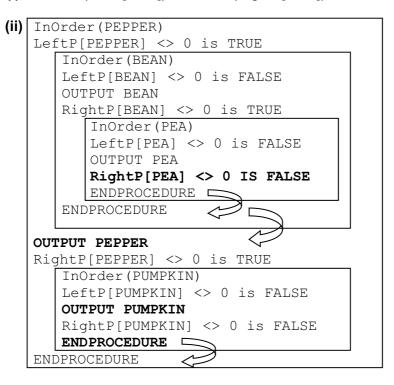
[1]

Correct right subtree

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(c) (i) InOrder(LeftP[Root]) // InOrder(RightP[Root])

[1]



[4]

(iii) The procedure has to backtrack/unwind from the current call

[1]

To return to the calling procedure // return to the addresses from which called

[1] [MAX 1]

[Total: 12]

	Page 1	Mark Scheme	Syllabus	Paper
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5	(a) (i) 7	The keyword table contains:	tohina takan	[4]

(a) (i)	The keyword table contains: all the language keywords/reserved words + with a matching token	[1]
	The symbol table stores: each identifier/variable found (and its data type)	[1]
	the values of all constants	[1]
	the upper and lower bounds of arrays [Mark as: 1 -	[1] + 1] [MAX 2]
(ii)	Keywords are looked up in the keyword table	[1]
	Keywords are converted to tokens	[1]
	Identifiers/Variables are looked up in the symbol table	[1]
	Identifiers/variables are converted to actual addresses	[1] [MAX 2]
(iii)	The white space // redundant characters are removed	[1]
/L-> /!>	Illegal identifier names are identified	[1] [MAX 1]
(b) (i)	Code will execute/run/process faster	[1]
	Code requires less memory Reduce the amount of code	[1]
	R. 'more efficient' // removes redundant code	
(ii)	Any example where the code could be changed E.g. input of a list of number to compute the total (There would be no need to sto numbers first)	[1] ore the

[Total: 8]

Page 8		3	Mark Scheme	Syllabus	Paper	
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(a)	(i)		ch processing nput/processing/output is performed as a batch		[1]	
		Ther	re may be a time delay before processing		[1]	
		All th	ne (data) is processed together/at the same time		[1]	
		Ther	re is no user involvement		[1]	
		Proc	cessing will not start until all the data is available/collec	ted	[1] [MA	X 3
	(ii)		ractive processing user is constantly interacting directly with the processor	or		[1]
(b)	(i)	PRC	OG23			[1]
	(ii)	Any	two from PROG17, PROG44 and 45			[1]
	(iii)	Jobs	s do not have to occupy a continuous block of memory		[1]	
			e all jobs still loaded in the partition so that when a job 'hole' remaining	completes there	is only ev [1]	er
		Mak	e the partitions of variable size		[1]	
		Allov	w only part of a program to be initially loaded // paging	//segmentation	[1] [MA	X 2]
(c)	Ор	eratin	g system // specific modules e.g. interrupt handler/sch	eduler, etc	[1]	
	dev	rice di	rivers		[1]	
	exa	mple	s of system software or utilities		[1]	
	R. '	'Syste	em software" and "Utilities"		[MA	X 2
(d)	Rui	nnable	e // Ready			[1]
			ram is capable of being run and is awaiting its turn for the nation of (only) 'ready to use the processor'	the use of the pro	cessor	[1]
	Sus	spend	led // Blocked			[1]
	dev	vice	ram is unable use the processor/ or by example, the jo	-	ng an I/O	[1]
	IVUI	. . 1116	s explanation marks are not dependant on the correct f	ıallı c	[Total:	. م

[Total: 14]

Page 9		Mark Scheme	Syllabus	Paper
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(a) (i)	2			[1]
(ii)	CON	MPILE ERROR // reporting an error		[1]
(iii)	0			[1]
(iv)	COM	MPILE ERROR // reporting an error		[1]
(b) (i)		CTION StringFound(ThisArray : STRING , U sValue : STRING) RETURNS BOOLEAN	Bound : INTE	GER,
		k as follows: CTION StringFound		[1]
	'Ar	ray variable' : STRING data type		[1]
	Thi	sValue : STRING // 'UBound' : INTEGER		[1]
(ii)	Num	nbered 1 – Parameter identifiers labelled		[1]
	Num	nbered 2 - (RETURNS) BOOLEAN		[1]
(iii)	Cit	yWasFound = StringFound(CapitalCities, 3	00, "LISBON")
		k as follows: yWasFound = StringFound([1]
	"LISI	BON" is the correct position (f/t from 'their' function hea	ader)	[1]
				[Total: 11]

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Question 8

(a)	(i)	Example	[1]
	(ii)	two of the points explained	
		moveable mechanical device	
		sense its surroundings clear example // temperature, etc. controlled by a program	[MAX 2]
(b)	Robotic arm		[1]
	Explained in the context of 'their' robot		[1]
	Sensor		[1]
	Capture data		[1]
	Act	uator // Motor	[1]
	То	drive various motors to perform the robot's movement	[1]
	Mic	roprocessor	[1]
	То	process the various inputs and execute the control program	[1]
	Car	mera	[1]
	То	capture images	[1]
	Mei	mory	[1]
		temporarily store input data	[1]
	Sne	eaker	[1]
	-		
	10	provide audio output	[1] [MAX 4]
(c)	rea	I-time	[1]
			[Total: 8]