



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme January 2004

GCE

Computing: Unit CPT4

The following notation is used in the mark scheme

- ; - means a single mark;
- / - means alternative response;
- A – means acceptable creditworthy answer;
- R – means reject answer as not creditworthy;
- I – means ignore.

1.	(a)	B76;	R lower case B	1
	(b)	$183\frac{3}{8}$;; 183.375;;	<i>one mark for correct integer part, one mark for correct fractional part</i>	2
	(c)	(i)	-36.5;;; <i>partial marks for workings if result incorrect: 1 mark for $\times 2^6$; accept showing that binary point moves 6 places right; 1 mark for negative number;</i>	3
		(ii)	a significant bit is stored after the binary point; bit after point different to bit before point; negative number starts with 10... positive number starts with 01....; to max	1
		(iii)	to maximise accuracy / number stored with maximum precision; A more accurate; a given number can only be expressed in one way in a given number of bits;	1
			Total	8
2.	(a)	male(peter).;	<i>Penalise once if capitals used instead of lower case</i>	1
	(b)	father(X,Y) IF male(X) AND parent (X,Y) // father(X,Y) IF parent(X,Y) AND NOT female(X);		1
	(c)	brother (X,Y) IF; parent(<u>Z</u> ,X) AND parent(<u>Z</u> ,Y); <i>accept father/mother instead of parent</i> AND male(X) AND male(Y);		
		OR		
		brother(X,Y) IF; mother(A,X) AND mother(A,Y) AND/OR father(B,X) AND father (B,Y); AND male(X) AND male(Y);		3
			Total	5

3.	(a)	(i)	56,576 / 13 x 16 ³ + 13 x 16 ² (<i>as final answer</i>);	1
		(ii)	16;	1
		(iii)	16;	1
		(iv)	512 ₍₁₀₎ ; 2 ⁹ ; A 200 ₁₆ ; A & 200;	1
	(b)	(i)	a signal/command/message; R request <u>from a device/source</u> seeking the attention of the processor; <i>or</i> <u>from a device/source</u> to the processor;	2
		(ii)	control bus; interrupt request line;	1
		(iii)	when buffer is full; when transfer is complete; R when buffer empty to max	1
			finish the current fetch-execute cycle; identify interrupt // type of interrupt is found; disable lower priority interrupts; save contents of registers // save volatile environment // save current status; jump to interrupt service routine // interrupt handler loaded // interrupt serviced; restore contents of registers // restore volatile environment; enable interrupts; R goes back to where it left off to max	3
			Total	11

4. (a) need to access/address machine registers / exact memory addresses / hardware directly;
 fast speed of operation required;
 code needs to take up little memory;
 A minimise the size of the program/code;
 no compiler/interpreter exists yet for machine // no other translator exists;
 R manipulate bits
 to max

2

- (b) *the assembly language instruction MOV or MOVE may be used in place of LOAD, LD, STORE, ST.*
Immediate addressing must be used for constants but could be indicated by annotation e.g. load register with 0. Indicate any omissions
A pseudocode statement gets no mark. Order of statements is important.
Ensure that loop continues while $x <> 999$.
If subtract is used in place of CMP check value of x is not destroyed.
If symbolic addressing not used, and statements are given addresses used in JMP instructions give 2 marks. Accept relative addressing for jumps.
No marks for jumps not altering flow of control.

	LOAD register,#0 / initialisation	1 mark
label1:		/ label 1 mark
	CMP register, # 999	/ compare 1 mark
	BEQ label2	/ correct branch to label 1 mark
	INC register or ADD register,#1	/ increment 1 mark
	JMP label1	/ unconditional branch 1 mark
label2:		/ correct label 1 mark
	STORE register, memorylocation	/ 1 mark
to max		

7

Total

9

5. (a) it calls itself / is defined in terms of itself / is re-entrant
 / contains within its body a reference to itself;
Ensure 'it' refers to procedure, if meaning program or object no mark 1

(b) the current state of the machine must be saved/preserved
 so can return correctly to previous invocation of B;
or
 return address / procedure parameter / status register / other register values /
 local variables must be saved/preserved so can return correctly to
 previous invocation of B); 1

(c)

Call Number	Parameter	
1	53	
2	26	
3	13	
4	6	;
5	3	;
6	1	;

Printed Output: 1 1 0 1 0 1;;; *one mark for each correct pair of bits
 mark from left and stop marking when error encountered
 ignore punctuation. if more than 6 bits give a max of 2 marks* 6

(d) conversion (of a denary number) into binary; 1

Total 9

6. Compare Newcastle with (middle item of list), Manchester;
 Compare Newcastle with (middle item of upper sublist), Sheffield;
 Compare Newcastle with Newcastle // compare only item (in lower sublist of
 this upper sublist) to get a match;
*Lose 1 mark if Newcastle not explicit in comparison
 stop marking from time it goes wrong*

or

List[4] = Newcastle? False; **A** [4] = Newcastle **R** 4 = Newcastle
 List[6] = Newcastle? False;
 List[5] = Newcastle? True;

if formula explicit, follow through on formula 3

Total 3

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8. (a) (i) the concurrent execution // apparent simultaneous execution (over the same time period) of two or more tasks // the concurrent execution of a group of co-operating/a single user's tasks;
A programs/processes R jobs / applications
between which communication is possible // to achieve some common goal;
R descriptions which imply multi-user or batch O.S. 2
- (ii) memory on hard disk;
(used when execution of a program/process)
where total virtual address space exceeds / program and data / main memory
needed exceed the physical/main memory capacity;
to store pages (of the process) / parts of the process not currently needed;
A program *instead of* process
lets user think there is more main memory/RAM // not enough main memory;
R computer fooled into thinking more main memory
A disk is used as RAM;
to max 2
- (iii) physical memory/RAM is conceptually divided into a number of (fixed size) page frames; A pages/segments;
(virtual address space of) program/process is divided into a number of (fixed size) pages;
page table indicates which pages of process are loaded (and where);
A page table keeps track of pages;
pages are swapped between disk and main memory as required
// pages are swapped into, and out of, memory as required;
No marks for a point which references just data when it should reference a program backing store is not acceptable as a substitute for disk
to max 2
- (b) (i) a thread is the processing performed on a single set of data in the system;
a thread is a process that shares most of its environment;
threads may be distinguished only by the value of their program counters and stack pointers;
several threads share one copy of program code;
a thread executes in the address space of its parent process; sharing global variables but with its own local variables;
a thread is a line of execution within a process; it has its own program counter, stack pointer and register values but runs in the same address space as other threads in the process; 2
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- (ii) threads have access to the same memory so they can communicate easily;
multi-threading allows threads to access the same data as they can access the same area of memory (RAM), separate processes do not allow this as they are self-contained;
only one copy of the program needs to be loaded;
saves main memory;
threads share more of their environment with each other than do processes;
faster execution than separate processes // faster execution overall;
Allow carry forward/back between (i) and (ii)
to max

1

Total

9

Grand Total

65
