GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Computing
Unit CPT4

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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) (i) city_in (london, uk); **1**

(ii) visited (strasbourg); **1**

(b) france; uk; **2**

(c) visited (City); AND city_in; (City, Country).;
or city_in; (City,Country); AND visited(City); **3**

Total 7

accept any variable name instead of City, but must be same in both places penalise once for wrong case (atoms, variables and predicates only)
A and
then *.....t.o. of one mark*
I *fullstop and any spurious punctuation*

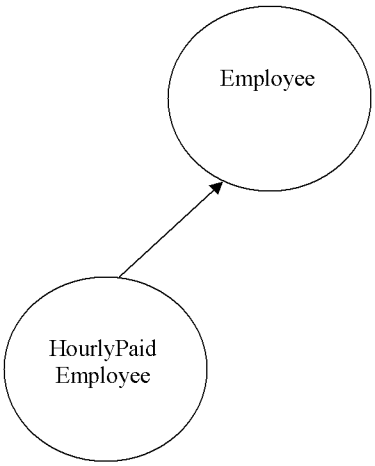
2. (a) from -2^{15}/-32,768; to 2^{15}-1/32767; **R** *binary;* **R** *one number unqualified* **2**

(b) 2^{10}-1 / 1023; **A** 1111111111_2; **A** &3FF; **A** $3FF_{16}$;

(c) Step 1: (Content of) PC copied into MAR // [PC] → MAR; *accept {} for []*
Step 2: (Content of) PC incremented (by 1) // [PC] incremented (by 1);
Step 3: content of Memory location addressed by MAR; loaded into MDR;//
MAR addresses a memory location; whose content is loaded into MDR;
Step 4: Content of MDR copied into CIR // [MDR] → CIR;
Step 5: Content of CIR decoded // [CIR] decoded // opcode/instruction/data decoded;
Step 6: instruction executed; **max 6**
step 2 could be after step 3,4 or step 5 but otherwise
order of steps must be as above, step(s) may be missed out
steps do not have to be one per line
P1 *of it is difficult to pick out the steps from prose.* **9**

A loaded/moved/stored for copied
A MBR for MDR
A IR for CIR
A SCR for PC

3. (a)



2

1 mark if correct hierarchy (including rectangles or round/oval shapes) in an inheritance diagram;
A *no shapes this year only*
1 mark for arrow in correct direction;

(b) different objects can respond to the same message in different ways;
Giving an action one name that is shared up and down an object hierarchy
with each object in the hierarchy implementing the action in a way appropriate to itself;
same name used in the class hierarchy for a method/action but each class implements this method differently; **max 1**

A *an example in context such as 'add' which behaves differently if used with strings than if used with numbers*

(c) THourlyPaidEmployee = Class (Employee)
(Public)
procedure CalculatePay (override)
procedure GetNumberOfHoursWorkedInMonth
Private
hourlyrate/hourlypay/HourlyPayRate: Currency
NumberOfHoursWorkedInMonth : Integar/Real/Float
End
OR

public class/subclas THourlyPaidEmployee extends/inherits TEmployee; **1**
{
public void calculatePay; **1**
public void getNumberOfHoursWorkedInMonth; **1**
private; float hourlyPayRate; **1 mark for private, 1 mark for var name**
private int numberOfHoursWorkedInMonth; **1**

Sub total 6

Total 9

}
Accept "Object" instead of "Class"
Accept Public implied
Lose one mark if properties from parent class included
R *any diagrams*

4. (a)

18: 0000 0000 0001 0010;

-6 1111 1111 1111 1010;

---

12 0000 0000 0000 1100; *if previous binary patterns correct* **4**

I mark for showing 16 bits throughout

(b) (i)

Symbolic Address	Hexadecimal Representation	Binary Representation	Decimal Value
Num2	A802	**1010 1000 0000 0010;**	**-2.75;;;**

if answer wrong give:
moving e places to right / exponent processing 2^e or equivalent: 1 mark
correctly identifying negative number 1 mark **4**
follow through if binary representation wrong

(ii) To maximise precision in a given number of bits // to minimise rounding errors
// to have just one representation of the decimal number // to simplify arithmetic operations; 1 mark
A to maximise accuracy in a given number of bits; **9**

5. (a)

Opcode	Operand(s)	Comment
LDA/ MOV/MOVE	3C5/ 3C5,R0 / R0,3C5;	Load contents of 3C5 into Accumulator *1 mark for correct opcode and operand*
OR;	#0010 0000B;; #&20;; #32;;	Logical OR with immediate address: set bit 5 (6th bit from the right). *1 mark for #/immediate addressing* *1 mark for correct value(accept without & or B)*
STA/ MOV/MOVE	3CB/ R0,3C5 / 3C5, R0;	Store result in memory location 3CB *Direction of MOV must be consistent with MOV statement above* *1 mark for correct opcode and operand*

Must have comments if unusual opcodes **max 4**

(b) it would remain in lower case//no change; **1**

Alternative answer:

(a)

Opcode	Operand(s)	Comment
LDA/ MOV/MOVE	3C5/ 3C5,R0 / R0,3C5;	Load contents of 3C5 into Accumulator *Direction of MOV must be consistent with MOV statement below* *1 mark for correct opcode and operand*
OR;	#0010 0000B;; #&20;; #32;;	Logical EOR/XOR with immediate address: set bit 5 (6th bit from the right). *1 mark for #/immediate addressing* *1 mark for correct value(accept without & or B)*
STA/ MOV/MOVE	3CB/ R0,3C5 / 3C5, R0;	Store result in memory location 3CB *Direction of MOV must be consistent with MOV statement above* *1 mark for correct opcode and operand*

Must have comments if unusual opcodes **max 4**

(b) it would change to upper case; **1 mark** **5**

part (b) must follow from consistent use of OR but
follow through if ADD is used instead of OR: ASCII code would be for a different character;

6 (a) code which can be loaded into any area in memory
/into a different area in memory each time it is run; **R** save instead of loaded **1**

(b) effective address = content of base register + offset/displacement/number;;;
in multi-programming o.s. all address references use base register addressing;
when a program is loaded into main memory;
the base register is loaded with address of base of memory block containing program;
so programs may be relocated/work anywhere in main memory;
base register addressing produces relocateable code;
every address is relative to the base register; **max 5** **6**

7 (a)

interactive	**batch:**	
user and computer in two way communication;	when processing begins, it continues from beginning to end without user interaction/intervention;	**max 1**
user communicates directly with program as it is running;	Program run in background with no interaction with the user;	**max 1**
processing carried out as users enter the data so results are available immediately;	Processing delayed until all data have been entered;	**max 1**

I purpose **max 2**

(b) job ID; priority; user name; job delimiters; job completion time;
approx execution time; max length of time job can run for; start time of job;
main memory required; devices/hardware required (eg printer);
compiler/assembler/software required; name of file/program to be executed;
what to do on non-successful completion of job;
data file required; output destination; **max 3**

(c) job requires i/o transfer; **A** process instead of job **R** program instead of job
job requires non-shareable resource which is already allocated;
job involves communicating with another process and expected message not arrived yet;
(some) error condition; **R** fatal error
operator intervenes to temporarily halt process; **max 2**

(d) circular queue//queue//linked list//priority queue//linked list of records;
R array *on its own* **1**

(e) the mix of processor and i/o bound jobs currently active;
the utilisation of hardware resources such as printer/memory;
the utilisation of processor // active list gets too short // room on active list //active list empty;
proximity of a deadline for a batch job;
time of day as interactive jobs tend to cease during night;
(batch) job in active list terminates therefore allowing another (batch) job to run;
priority;
time waiting in inactive list; **Max 2**

Total 10

8 (a) a procedure/routine which calls itself//is defined in terms of itself; **R** re-entrant; **1**

A function instead of procedure **R** program
iteration Talked Out (no mark)

(b) (i)

E	L	H	M	List[M]	Printed Output
6502	1	11 ;	6	5789 ;	
6502	7	11 ;	9	8407 ;	
6502	7	8 ;	7	6502 ;	
					True;

Accept True *in row 3*
Marks in each row for all three/two parts correct
Accept empty cell to mean: same as in previous row.
Stop marking when logic goes wrong **7**

(ii) binary search;;
search;
R any other type of search **2**

Total 10

END OF CPT4 MARK SCHEME