GCE 2004
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AQA

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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
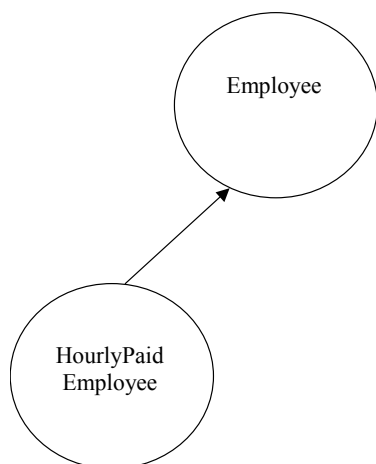   then .....*t.o. of one mark*
    I *fullstop and any spurious punctuation*

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] $\rightarrow$ 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] $\rightarrow$ CIR;
Step 5: Content of CIR decoded // [CIR] decoded // opcode/instruction/data
decoded;
Step 6: <u>instruction executed</u>;   **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)

Employee

HourlyPaid
Employee

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 <u>CalculatePay</u> (override)
                procedure <u>Get</u>NumberOf<u>Hours</u>WorkedInMonth
        Private
                <u>hourlyrate</u>/<u>hourlypay</u>/Hourly<u>PayRate</u>: Currency
                NumberOf<u>Hours</u>WorkedInMonth : 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 <u>in a given number of bits</u> // to minimise rounding errors
// to have just one representation of the decimal number // to simplify arithmetic operations;   1 mark
A to maximise accuracy <u>in a given number of bits</u>;   **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 <u>memory</u>
/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 <u>main</u> memory;
the base register is loaded with address of base of memory block containing
program;
so programs may be relocated/work anywhere in main <u>memory</u>;
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;
<u>main</u> 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) <u>error</u> condition; **R** fatal error
operator intervenes to <u>temporarily</u> 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