M11/5/COMSC/HP1/ENG/TZ0/XX/M

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MARKSCHEME

May 2011

COMPUTER SCIENCE

Higher Level

Paper 1

10 pages

General Marking Instructions

Subject Details: Computer Science HL Paper 1 Markscheme

Mark Allocation

Section A: Candidates are required to answer **all** questions. Total 40 marks.
Section B: Candidates are required to answer **all** questions. Total 60 marks.
Maximum total = 100 marks.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for that part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- Each statement worth one point has a separate line and the end is signified by means of a semi-colon (;).
- An alternative answer or wording is indicated in the markscheme by a "/"; either wording can be accepted.
- Words in (…) in the markscheme are not necessary to gain the mark.
- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the markscheme then award the mark.
- Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing them for what they have not achieved or what they have got wrong.
- Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized.

SECTION A *Total: [40 marks]*

1. *Award up to **[2 marks max]**.*

Example answers:

A compiler produces an executable / machine code / object code file whereas an interpreter compiles and executes each line of code without saving a compiled copy.

A compiler does not execute any code until the translation process is complete whereas an interpreter executes each line of code as soon as it has translated it.

A compiler will not run any code until all syntax errors are eliminated whereas an interpreter will translate and execute each line of code until it encounters a syntax error. ***[2 marks]***

2. *Award **[2 marks]** for any suitable application outlined in part (a) and part (b).*

Example answers:

(a) Scanning text into a computer readable form;
So that it can be edited (on a computer);

Award marks for other examples that may be mentioned here:
Banks process checks without human involvement;
Digital library initiatives are adopting advanced OCR technology to convert large book collections for on-line viewing of content (they provide a high degree of reliability); ***[2 marks]***

(b) Ticket machine at a train station;
Screen allows you to select options / work through menus;

Award marks for other examples that may be mentioned here:
Information Kiosk Systems used for product information or advertisements or as guides at museums;
The touch screen lets DJs manipulate and play music; ***[2 marks]***

3. (a) Allocates an appropriate section / amount of memory;
For each program (currently) running;
Do not accept answers describing the management of hard drives. ***[2 marks]***

(b) Deals with passwords / access levels;
So that only the appropriate person(s) can work with particular files;
Do not accept answers describing firewall and anti-virus functions. ***[2 marks]***

4. (a) 010001; ***[1 mark]***

(b) 101111; ***[1 mark]***

5. Defragmentation software places sections of the same file next to each other;
To allow for faster access (to that file);
Do not credit answers which imply that extra space is created. ***[2 marks]***

6. (a) `(double)(11 % 2) / 2 = 1.0/2 = 0.5;` ***[1 mark]***
*Award **[1 mark]** for 0.5. Working does not need to be shown.*

(b) To prevent a possible "division by zero" / run-time/execution error / program from crashing; ***[1 mark]***

(c) *Award up to **[2 marks max]**.*
Because (otherwise) the operator "`/`" will perform integer division;
And return the answer `0`;
And the method has to return a **`double`**;
The cast `(double)` ensures that `(x % y)` is of type **`double`**;
So real division is carried out/better accuracy;
So the cast / `(double)` converts the answer to a **`double`**; ***[2 marks]***

7. Data could be compressed (before sending);
Which means less data to send;

High speed lines / fibre optics / dedicated lines could be used;
Which allow faster transmission than "traditional lines";
Or
Greater the bandwidth of a communication channel;
The higher the data transfer rate; ***[4 marks]***

8. (a) *Award up to **[2 marks max]**.*
A truncation error is one in which bits can be lost from a number;
Due to only a certain number of bits being allocated for storing that number;
Which will result in an incorrect value being stored / displayed; ***[2 marks]***

(b) *Award up to **[2 marks max]**.*
A floating-point representation might not have enough bits allocated to the mantissa;
To hold / store the results of an operation;
Or
A fixed point representation might not have enough bits allocated for the fraction;
To hold / store the results of an operation; ***[2 marks]***

9. (a) *Award **[1 mark]** for the correct inputs, **[1 mark]** for the correct answer.*

A	B	A nand B
0	0	1
0	1	1
1	0	1
1	1	0

[2 marks]

(b) $A \bullet B + A$; ***[1 mark]***

(c) *Allow follow through from part (b).*
$A \bullet B + A = A$; ***[1 mark]***

10. (a) *Award up to **[1 mark max]**.*
Return addresses (for subroutines) might be placed on a stack;
Stacks are used in evaluating expressions;
Stacks are used in translating from one computer language to another;
All processing is based on the Last-In-First-Out (LIFO) policy; ***[1 mark]***

(b) *Award up to **[1 mark max]**.*
Key strokes from a keyboard would be placed in a queue;
Items from processor/memory to output to a peripheral device would be place in a queue;
Programs which are ready to run are placed in a queue;
Queues are used in simulation processes;
Supports remove and insert operations using FIFO (First-In-First-Out) mode; ***[1 mark]***

11. *Award up to **[2 marks max]**.*
A gateway provides the link between systems;
By providing the appropriate conversions / adding the appropriate data;
It is a network point that leads to another network, may be with different protocols; ***[2 marks]***

12. (a) *Award up to **[2 marks max]**.*
The exchange of (predetermined) signals / messages;
When a connection is established between two devices or components;
To establish that the devices are ready to exchange data; ***[2 marks]***

(b) *Award up to **[2 marks max]**.*
Interrogation / checking of a device / sensor / series of sensors;
To see if action needs to be taken (or equivalent);
In a rotational order (as in round-robin sequence); ***[2 marks]***

13. *Award **[2 marks]** if completely correct, or **[1 mark]** for only one error.*
Coffee, Beer, Tea, Lemonade, Milk, Soda, Water, Wine ***[2 marks]***

SECTION B *Total: [60 marks]*

14. (a) *Award **[1 mark]** for the method of data collection, **[1 mark]** for the benefit, up to **[4 marks max]**.*

Observation;
Allows the analyst to see exactly how the processes are carried out;

Questionnaires;
Can cover every aspect;
Can (potentially) reach every employee;

Research;
Allows analyst to see how other similar businesses solve the problem;
Relatively cheap to administer;

Interviews;
Interaction allows all aspects to be thoroughly investigated;
Structured interviews provide ability to record the emotion and explore further into pros and cons of a particular application (although budgeting time for interviews needs care); ***[4 marks]***

(b) (i) *Award **[1 mark]** for "feasibility report", **[1 mark]** for at least two items from the report list.*

Feasibility report;
Containing: a brief description of the proposed system / estimated costs / economic / technical / and legal responsibility / and a possible completion date; ***[2 marks]***

(ii) *Award **[1 mark]** for "requirements specification", **[1 mark]** for at least two items from the report list.*

Requirements specification;
A (precise) definition of the problem, a definition of inputs and outputs, a list of tools, facilities, people available for developing the solution, a schedule for the next stages of the project, systems flowchart (or similar diagrams); ***[2 marks]***

(c) *Award up to **[2 marks max]**.*
All stages are after the analysis stage so award marks for any additional documentation.

Example answers:

User guide;
For the personnel that will use the system;

Flowcharts / **code**;
To aid programmers in future modifications;

Technical documentation;
Helps future teams to alter/improve the system;

Interactive prototypes;
Consistency must be ensured in re-designing; ***[2 marks]***

Total: [10 marks]

15. (a) (i) It is within the ALU;
Temporarily stores the results of any calculation; ***[2 marks]***

(ii) *Award up to **[2 marks max]**.*
It is within the CU;
Stores the instruction/op code of instruction;
That is currently being processed; ***[2 marks]***

(iii) It is within the CU;
Stores the address of the next instruction to be executed;
Incremented each time an instruction is carried out; ***[2 marks]***

(b) *Award **[1 mark]** for the bus, **[1 mark]** for the role, up to **[4 marks max]**.*
Address bus;
Provides the pathway from the memory to the processing unit that carries the address in memory to and from which data is transferred;

The address can only be passed from the CPU to external memory or I / O ports (one way);

Data bus/*accept memory bus*;
Carries the data to and from the memory/registers within the CPU; (bi-directional)

Control bus;
Carries the read/write signals/interrupt request signal/reset signal between different parts of the processor; ***[4 marks]***

Total: [10 marks]

16. (a) The method is called from within itself (allow the actual code); ***[1 mark]***

(b) *Award **[1 mark]** for each correct row.*

target	low	high	middle	return value
9	0	6	3	
9	0	2	1	
9	2	2	2	2

[3 marks]

(c) Otherwise the processing will never change;
Which will lead to an infinite loop; ***[2 marks]***

(d) (i) O(log(n)); ***[1 mark]***

(ii) O(n); ***[1 mark]***
Accept notation log n and n.

(e) A binary search is more efficient because it eliminates one half of the set with each comparison (since the pre-condition for binary search is that the array must be sorted in some order);
Whilst a linear search works its way through the whole list; ***[2 marks]***

Total: [10 marks]

17. (a) (i) The processing of the staff's wages/total patients expenses;
Which will take place at regular intervals / each month; ***[2 marks]***

(ii) Booking appointments;
Over the Internet; ***[2 marks]***

(iii) *Award up to **[2 marks max]**.*
Monitoring of intensive care patients;
Made possible by patient and staff alerts being interactive;
Must react immediately to any changes/safety-critical; ***[2 marks]***

(b) *Award marks as follows, up to **[4 marks max]**.*
*Award **[1–2 marks]** if the relative importance of the systems are addressed.*
*Award **[3–4 marks]** if the relative importance of all three of the systems are addressed and examples are also given.*

The **batch** and on-line would cause inconvenience but would not be critical;
Could perhaps be routed through other systems;
Or suspended until system is back on-line;
Real-time system would be critical;
Could cause patient deaths;
Therefore must have immediate back-up system; ***[4 marks]***

Total: [10 marks]

18. (a) 000110.11; ***[1 mark]***

(b) Decimal fractions other than $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ / example of a decimal fraction that cannot be converted;
Will not be able to be converted exactly into the binary representation; ***[2 marks]***

(c) The precision / accuracy will be increased;
(But) the range will be decreased; ***[2 marks]***

(d) $9\frac{1}{2}$ / 9.5 ***[2 marks]***
*(Award **[1 mark]** for the correct evaluation of the mantissa and exponent but with an incorrect final answer.)*

(e) 010010 0010 ***[3 marks]***

*(Award **[1 mark]** for normalization*
($2.25_{(10)} = 10.01_{(2)} = \{normalization\} = 0.1001_{(2)} \times 10^{10}{}_{(2)}$);
*Award **[1 mark]** for the mantissa (010010);*
*Award **[1 mark]** for the exponent (0010);*

Total: [10 marks]

19. (a) *Award up to **[2 marks max]**.*
Standard protocols are rules/procedures;
Governing the transmission of data;
That allow data to be correctly received; ***[2 marks]***

(b) *Award **[1 mark]** for each difference, up to **[2 marks max]**.*
Data security
Deals with preventing the data being intercepted by a third party (or equivalent);
Ensures that the people who must have access to data are the only ones who can have access to it;
Whilst
Data integrity is concerned with the data not being altered during transmission;
Making sure that the data is complete and not corrupted; ***[2 marks]***

(c) (i) *Award up to **[2 marks max]**.*
Data is not sent as one unit / all together;
But is divided / sent in separate packets;
Each packet is formatted, addressed and routed;
Packets sent (possibly) by different routes;
Making the complete message more difficult to intercept; ***[2 marks]***

(ii) Individual packets can be sent by different routes;
So if one route is down, others can be used; ***[2 marks]***

(d) As each packet contains control data / packet sequence number;
Receiving computer can combine packets in correct order; ***[2 marks]***

Total: [10 marks]