



MARKSCHEME

May 2010

COMPUTER SCIENCE

Higher Level

Paper 1

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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 penalising them for what they have not achieved or what they have got wrong.
- Remember that many candidates are writing in a second language; be forgiving of minor linguistic slips. In this subject effective communication is more important than grammatical accuracy.
- 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. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with “**FT**”.

SECTION A

Total: [40 marks]

1. *Award up to [2 marks max].*
A list of available tools/hardware/software *etc.*;
Facilities;
Communication;
People available;
Schedule for the next stage;
etc. **[2 marks]**

2. (a) 11A **[2 marks]**
(b) 0001 0001 1010 ; **[1 mark]**
(c) Overflow; **[1 mark]**

3. *Award up to [2 marks max].*
The ALU receives data to be processed;
Performs arithmetical;
And logical operations;
(Uses logic gates) to perform the calculations;
(Uses logic gates) to perform comparisons;
Returns the answer to the accumulator / (output registers); **[2 marks]**

4. *Accept any reasonable answers, given that characteristics evolve rapidly.*

Award up to [2 marks max] for an appropriate application of each with reference to backup.
Example:
Tape could be used for regular backup of large amounts of data, flash memory to back up immediately when needed.

Award up to [2 marks max] for the advantages/disadvantages of each.
Example1:
Flash memory is more portable between machines – tape has large capacity and can be programmed to back up as a batch job.
Example2:
Tape has sequential access (slower), flash memory has direct access (faster).
Example3:
Tape is cheaper per GB but hardware needed is more expensive. **[4 marks]**

5. Private class members can only be accessed from within the class (in which they are defined);
Public class members can be accessed from outside the class; **[2 marks]**

6. (a) Award **[1 mark]** for suitable macro and **[1 mark]** for appropriate package up to **[2 marks max]**.
Example:
 A macro to clear/update entries in a spreadsheet;
 A macro to type a name using a hotkey in a word processor;
 Creating a circle for a given radius in a graphics package; **[2 marks]**
- (b) Award **[1 mark]** for each suitable advantage.
Example:
 Saves time as code does not have to be reproduced;
 Portability – can be used again (sometimes across different applications);
 Adaptability – can easily be changed to suit needs; **[2 marks]**
7. Award up to **[3 marks max]**.
 Checksum is computed from data;
 Groups of bits are added before transmission and the sum appended to the group;
 When the data is received the actual sum is compared with the check sum;
 If the two are the same it is assumed that the data has not been corrupted;
 Otherwise a re-send would be requested; **[3 marks]**
8. Award up to **[2 marks max]**.
 Saves time for the programmer in the long term as an interface is created which may not be accepted;
 Early feedback from user could save later changes which could be difficult/time consuming;
 More user/programmer interaction – increases the programmers understanding of the problem; **[2 marks]**
9. (a) Award **[1 mark]** for each **appropriate** use of an interrupt up to **[2 marks max]**.
Example:
 Interrupt used to indicate that a client wants access to the server (in a multi access system);
 A peripheral needs serving (load CD, printer *etc.*);
 Software application reports an error;
 Power problem alert (battery low, blackout *etc.*); **[2 marks]**
- (b) Award up to **[2 marks max]**.
 Operating system is alerted that a service is needed (*i.e.* flag set);
 Depending on the priority;
 Current processing is suspended;
 Stack used to store current state;
 Service dealt with and processing resumed; **[2 marks]**
10. Award up to **[3 marks max]**.
 Search engine accesses a list of URLs;
 Indexed by key words;
 List of addresses under these key words returned;
 Accept reference to importance of key words in the ordering of the returned websites; **[3 marks]**

11. *Accept points in (i) that are given in (ii) for both (a) and (b).*

- (a) (i) Serial transmission receives/sends data bit by bit, sequentially;
Is suitable for long distance cables as data is less likely to corrupt on one line; **[2 marks]**
- (ii) Connecting computers in a LAN; **[1 mark]**
- (b) (i) Parallel transmission receives/sends data more than 1 (normally 8) bits at a time, in parallel;
Is suitable for short distance since data on parallel line can get “out of sync” in long distance; **[2 marks]**
- (ii) *Award [1 mark max].*
Transmission within the CPU;
Transmission within the computer/from printer to computer; **[1 mark]**

- 12.** (a) Virtual memory is a way of appearing to extend primary memory;
By using part of secondary memory in the same way as primary memory; **[2 marks]**
- (b) Part of the program (or data) is held on hard disk;
Called in (by paging) when needed; **[2 marks]**

SECTION B

Total: [60 marks]

13. (a) Data type for the thickness would need to be floating point (double);
Small changes would need to be recorded; **[2 marks]**

- (b) Award **[1 mark]** for suitable method and **[1 mark]** for an elaboration up to **[2 marks max]**.

Example:

Use sensors on current routes (that could be replaced by the road bridge);
To count the amount of traffic which might use the bridge;
At different times of the day;

Example:

Use questionnaires/interviews at different points on the route;
At different times of the day;
To find out how many vehicles would use the bridge instead of the current routes; **[2 marks]**

- (c) Award up to **[4 marks max]**.
Simulate normal and extreme traffic flow;
Increase amount of traffic until bridge not stable;
Or amount of traffic impossible;
Repeat with different thicknesses;
To obtain suitable thickness; **[4 marks]**

- (d) Award **[1 mark]** for an advantage and **[1 mark]** for an elaboration up to **[2 marks max]**.

Example:

Saves cost;
Since once the software and hardware are bought they can be used for many different projects whereas a physical model would have to be built each time;

Example:

More accurate;
As many more factors can be taken into account and smaller changes can be made; **[2 marks]**

Total: [10 marks]

14. (a) Sequential / linear search (on key – customer name);
O(n);
*Award **FT** mark for correct efficiency.* [2 marks]
- (b) Binary search (on key – customer ID);
O(log n);
*Award **FT** mark for correct efficiency.* [2 marks]
- (c) Batch processing; [1 mark]
- (d) *Award [3 marks max] for advantages elaborated and [3 marks max] for disadvantages elaborated up to [5 marks max].*

Example advantages:

There is no extra cost;

Benefits can be gained immediately;

Since new system is better than the old;

Example disadvantages:

Staff re-training will be more lengthy/difficult/in advance/not on the system;

As they will need to be capable of using the system immediately without training;

If there is an unsuspected bug in the new system;

There is not a second system to fall back on/disastrous for the company;

Accept answers which give valid advantages or disadvantages to changing the system when it is not being used. [5 marks]

Total: [10 marks]

15. (a) Held in ROM;
Award [1 mark] for any reasonable data that would be in ROM.
Example:
Instructions to be activated for each separate program;
Start up instructions;
Instructions to take information from sensors; [2 marks]
- (b) Held in RAM;
Award [1 mark] for any reasonable data that would be in RAM.
Example:
Time to start set by user;
Settings input by user;
Current state of variables; [2 marks]
- (c) Award [3 marks] if correct answer arrived at even without working. Otherwise award [1 mark] for each correct step ([2 marks max] if incorrect answer).

EITHER

$$\begin{aligned} M &= W' \cdot H \cdot R' + W' \cdot H \cdot R + W \cdot H' \cdot R + W \cdot H \cdot R \\ &= W' (H \cdot R' + H \cdot R) + W \cdot R (H + H') \\ &= W' \cdot H + W \cdot R \end{aligned}$$

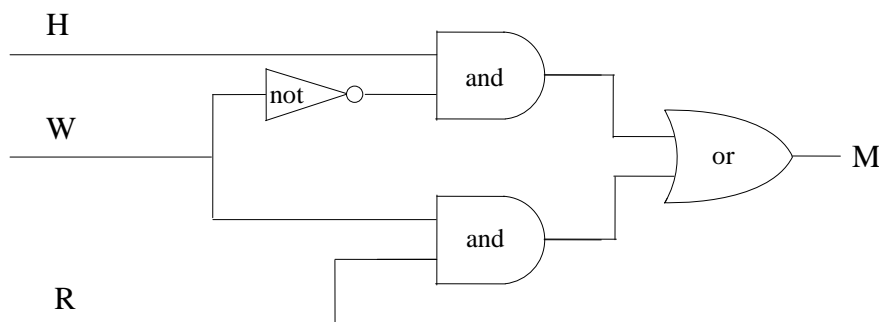
OR

$$\begin{aligned} M &= \bar{W} \cdot H \cdot \bar{R} + \bar{W} \cdot H \cdot R + W \cdot \bar{H} \cdot R + W \cdot H \cdot R \\ &= W (H \cdot \bar{R} + H \cdot R) + W \cdot R (H + \bar{H}) \\ &= \bar{W} \cdot H + W \cdot R \end{aligned}$$

OR

$$\begin{aligned} M &= (\text{not}W \text{ and } H \text{ and not}R) \text{ or } (\text{not}W \text{ and } H \text{ and } R) \text{ or } (W \text{ and not}H \text{ and } R) \\ &\quad \text{or } (W \text{ and } H \text{ and } R) \\ &= \text{not}W(H \text{ and not}R \text{ or } H \text{ and } R) \text{ or } W \text{ and } R(H \text{ or not}H) \\ &= (\text{not}W \text{ and } H) \text{ or } (W \text{ and } R) \end{aligned} \quad [3 \text{ marks}]$$

- (d) Award [1 mark] for each correct entry into each correct gate [3 marks max].
Allow follow through – i.e. if only two gates then [2 marks max].



[3 marks]

Total: [10 marks]

16. (a) Award [1 mark max].

When

```
n / 10 ≤ 0;
NOT (n / 10 > 0);
(n / 10 > 0) == false;
```

[1 mark]

- (b) There are many different ways of tracing a recursive algorithm. Accept any method but award marks as follows:

[1 mark] for each correct call (i.e. n and b correct) to question up to [4 marks max].

[1 mark] for returning and adding to the final return of 11.

Award up to [2 marks max] for a consistent error which demonstrates understanding of recursion.

Example:

n	n / 10 > 0	b	y	return
1011	True	1	1	8+0+2+1=11
101	True	2	2	8+0+2=10
10	True	4	0	8+0=8
1	False	8		8

Example:

Entering question with n = 1011; b = 1

n / 10 > 0 is true

y = 1

Entering question with n = 101; b = 2

n / 10 > 0 is true

y = 2

Entering question with n = 10; b = 4

n / 10 > 0 is true

y = 0

Entering question with n = 1; b = 8

n / 10 > 0 is false

Returning with 8

Returning with 0 + 8 = 8

Returning with 2 + 8 = 10

Returning with 1 + 10 = 11

Result = 11

Example:

n	y	question
1011	1	(1011, 1)
101	2	(101, 2)
10	0	(10, 4)
1	8	(1, 8)

Returned 1+2+0+8=11

[5 marks]

continued ...

Question 16 continued

- (c) *Award [2 marks] for an advantage explained and [2 marks] for a disadvantage explained.*

Advantage:

- Less code to write;
- Less repetition than in iteration methods;

Disadvantage:

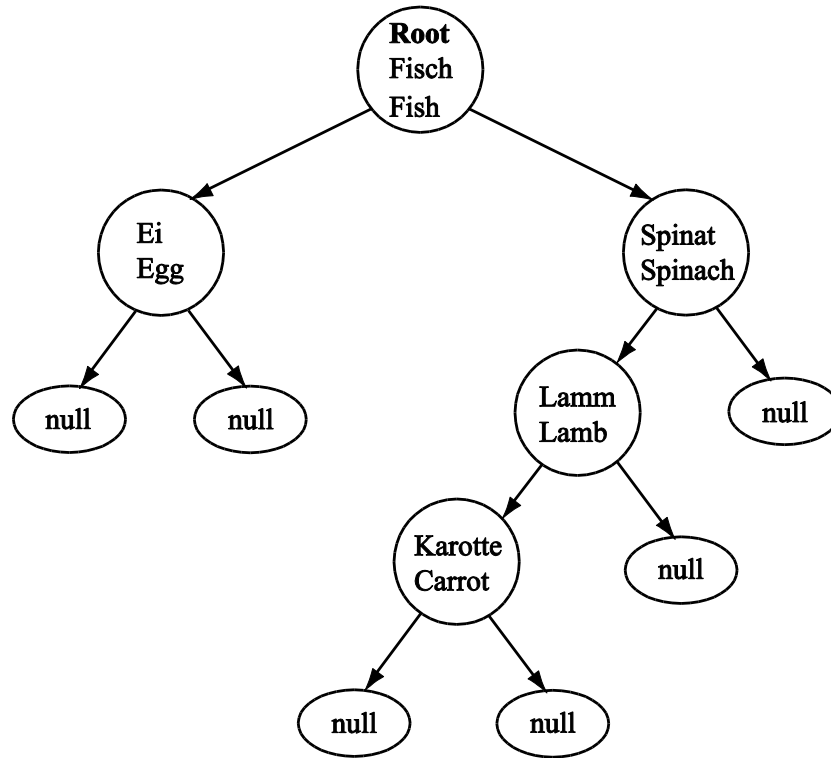
- More complicated to code;
- Slower Execution;
- Can use more memory when executed;

[4 marks]

Total: [10 marks]

17. (a) Award marks as follows up to **[4 marks max]**.
 Award **[1 mark]** for correct root (the word “Root” does not have to appear).
 Award **[2 marks]** for correct order (allow mirror image).
 (Award **[1 mark]** if there is no more than one mistake.)
 (Award **[1 mark]** if there is only the German word.)
 Award **[1 mark]** for correct null pointers.

[4 marks]



- (b) (i) Award **[1 mark]** for a suitable advantage and **[1 mark]** for an elaboration up to **[2 marks max]**.

Example:

A binary tree is quick to search;

Especially if it is well balanced as the number of comparisons is small;

[2 marks]

- (ii) Award **[1 mark]** for a suitable advantage and **[1 mark]** for an elaboration up to **[2 marks max]**.

Example:

A single linked list is efficient in adding and deleting items;

As only the pointers have to be readjusted;

[2 marks]

- (c) Award **[1 mark]** for a suitable suggestion and **[1 mark]** for an elaboration up to **[2 marks max]**.

Example:

A second set of pointers could be introduced to give English alphabetical order;

Head (root) pointer would point to the first word in English and the tail would be

after the last word in alphabetical order;

Doubly linked list with two external pointers;

First to give German and second to give English alphabetical order;

[2 marks]

Total: [10 marks]

18. (a) **Verification:** The potential member will have to type in their password twice and it will be checked against the first one;
Validation: The format of payment details/personal details will be checked against the expected format and rejected if they are not of the correct format; [2 marks]
- (b) *Award up to [3 marks max].*
 When member first applies the payment method;
 The personal details should be encrypted;
 Each time the member logs in, user name and password should be encrypted;
 For transmission between member computer and server (accept this once anywhere); [3 marks]
- (c) *Award up to [2 marks max].*
 The protocols are an agreed way/set of rules for communicating when transferring data;
 Protocol ensures that the data is accepted and understood by the receiver;
 Packets of data include information to get from sender to receiver;
 Each packet will contain destination/number in packet;
 Protocols ensure that machines with different platforms can communicate; [2 marks]
- (d) Each time an order is confirmed/article bought the number in stock is reduced by one; [1 mark]
- (e) *Award up to [2 marks max].*
 When a member makes an enquiry (if stock is low);
 That item is made unavailable/blocked to others;
 If bought the item is then unavailable until restocked or removed from site;
 If not bought it is unblocked;
- Accept also*
 A system that does not block but halts a member in the process of buying;
 To say that it is no longer available if another member has bought in the meantime; [2 marks]

Total: [10 marks]