



MARKSCHEME

May 2007

COMPUTER SCIENCE

Higher Level

Paper 1

*This markscheme is **confidential** and for the exclusive use of examiners in this examination session.*

*It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of IBCA.*

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 part of a question.

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

- Each marking point has a separate line.
- 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 mark scheme 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. Effective communication is more important than grammatical niceties.
- 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

[40 marks]

1. Award **[1 mark]** for one of following.
 - (a) advantage
limited disruption;
immediate benefit;
typically lower cost compared to parallel; **[1 mark max]**
 - (b) disadvantage
high risk if system fails; **[1 mark]**

2. (a) $O(n^2)$; **[1 mark]**
(b) $O(n \log_2 n)$; **[1 mark]**

3. the role of the key field is to allow records to be uniquely identified **[1 mark]** during searching/retrieval or defining relationships. **[1 mark]**

4. when a data set is too large **[1 mark]** to fit into available primary memory. **[1 mark]**

5. Award **[1 mark]** to each of the following up to **[4 marks max]**.
Fetch instruction, update program counter, execute, update, decode, store, check interrupt register. **[4 marks max]**

6. Award **[1 mark]** for each reasonable example up to **[3 marks max]**.
 - (a) Batch: cheque production and printing. **[1 mark]**
 - (b) Real-Time: automatic calculation of fuel price during pump operation. **[1 mark]**
 - (c) Online: customer enquiry on bank account via an ATM. **[1 mark]**

- 7. reduces congestion (accept: load, traffic, broadcasts) **[1 mark]** as network link (device to hub) is not shared **[1 mark]**.

reduces full network failure **[1 mark]** because if hub to device cable breaks the entire network can continue to function **[1 mark]**.

additional lines can be added **[1 mark]** without causing disruption to other network devices **[1 mark]**. **[2 marks max]**

- 8. No; **[1 mark]**

- 9. (a) Award **[2 marks]** for 1110001, **[1 mark]** if 7 bits used and the MSB = -1 but the remainder are incorrect.

$$-15 = -64 + x \Rightarrow x = 64 - 15 = 49$$

| | | | | | | |
|-----|----|----|---|---|---|---|
| -64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 |

[2 marks]

- (b)

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |

The addition results in a binary carry **[1 mark]** into the 7th position, hence an overflow occurs but is not detected as the value is negative **[1 mark]**. **[2 marks]**

- 10. (a) analog data is represented by a continuous variable quantity; **[1 mark]**

- (b) to enter and store analog **[1 mark]** temperature data, the data needs are converted to a digital representation using an A-D converter **[1 mark]**. **[2 marks]**

- 11. packets can be shipped via any combination of nodes **[1 mark]**, hence the protocol must be able to enable the packets to be assembled into the correct order **[1 mark]** at the receiving end. **[2 marks]**

- 12. Award **[1 mark]** for each of seek, wait and transfer times up to **[3 marks max]**.
total access time = seek track + wait/latency/rotation delay/spin delay for sector + total transfer of each block of data. **[3 marks max]**

13. (a) role of the index is to indicate the position [*1 mark*] in the array of the required data element to enable direct access [*1 mark*]. [*2 marks*]
- (b) Wong; [*1 mark*]
- (c) denotes the data type [*1 mark*] to enable compiler to allocate correct memory [*1 mark*]. [*2 marks*]
14. (a) attempt to divide by zero [*1 mark*], error occurs because this is an illegal operation for the compiler [*1 mark*]. [*2 marks*]
- (b) test the value of divisor [*1 mark*], if it is zero do not do division [*1 mark*]. [*2 marks*]
15. data on disk is stored in blocks;
as blocks are added or deleted they become separated;
slows down file access;
defrag software re-configures the blocks to be next to each other; [*3 marks max*]

SECTION B

[60 marks]

16. (a) Award **[1 mark]** for each fully correct row up to **[5 marks max]**.

| i | p | m | c[m] |
|---|---|------------|-----------|
| 0 | c | 99-97 is 2 | c[2] is 1 |
| 1 | a | 97-97 is 0 | c[0] is 1 |
| 2 | c | 2 | c[2] is 2 |
| 3 | b | 1 | c[1] is 1 |
| 4 | c | 2 | c[2] is 3 |
| | | | |

[5 marks max]

(b) Award **[1 mark]** for ALL correct, **[0 marks]** if one or more incorrect.
1, 1, 3;

[1 mark]

(c) Award **[1 mark]** for each row correct up to **[2 marks max]**.

a 1
b 1
c 3

[2 marks max]

(d) the algorithm performs a frequency count of the different letters in the array **[1 mark]**, and then displays this frequency count **[1 mark]**. **[2 marks]**

17. (a) Award [1 mark] for each correct column 1,2 or 3 up to [3 marks max].

| | | | | 1 | 2 | 3 |
|---|---|---|-----------|-----|-------------|------------------|
| D | K | S | \bar{S} | D.K | $\bar{S}.K$ | D.K+ $\bar{S}.K$ |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 |

[3 marks max]

(b) Award [1 mark] for each correct mini-term up to [3 marks max].

$$f = \bar{D}.K.\bar{S} + D.K.\bar{S} + D.K.S$$

[3 marks max]

(c) Using Boolean Logic

$$f = \bar{D}.K.\bar{S} + D.K;$$

[1 mark]

$$f = K.(\bar{D}.\bar{S} + D)$$

$$f = K.(\bar{S} + D);$$

[1 mark]

OR

Using K=Map

| d/k | 00 | 01 | 11 | 10 |
|-----|----|----|----|----|
| s 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 0 |

Award [1 mark] for complete K-map.

[1 mark]

Award [1 mark], with the K-map students do not need to minimise further.

$$f = K\bar{S} + DK;$$

[1 mark]

OR

Reasoning

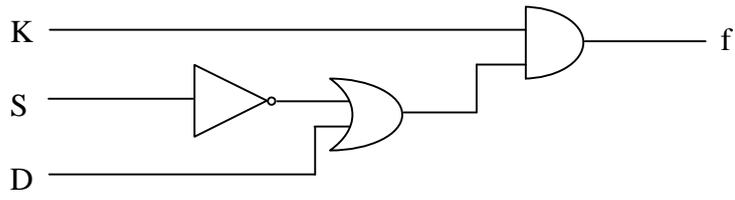
Award [1 mark] for the correct terms inside the two brackets () and [1 mark] for correct use of OR.

Student can state the minimized circuit by simply reading the logic from the question, but they need to give some explanation as to how they reasoned.

(Door Open AND Key) OR (not Seat belt and Key)

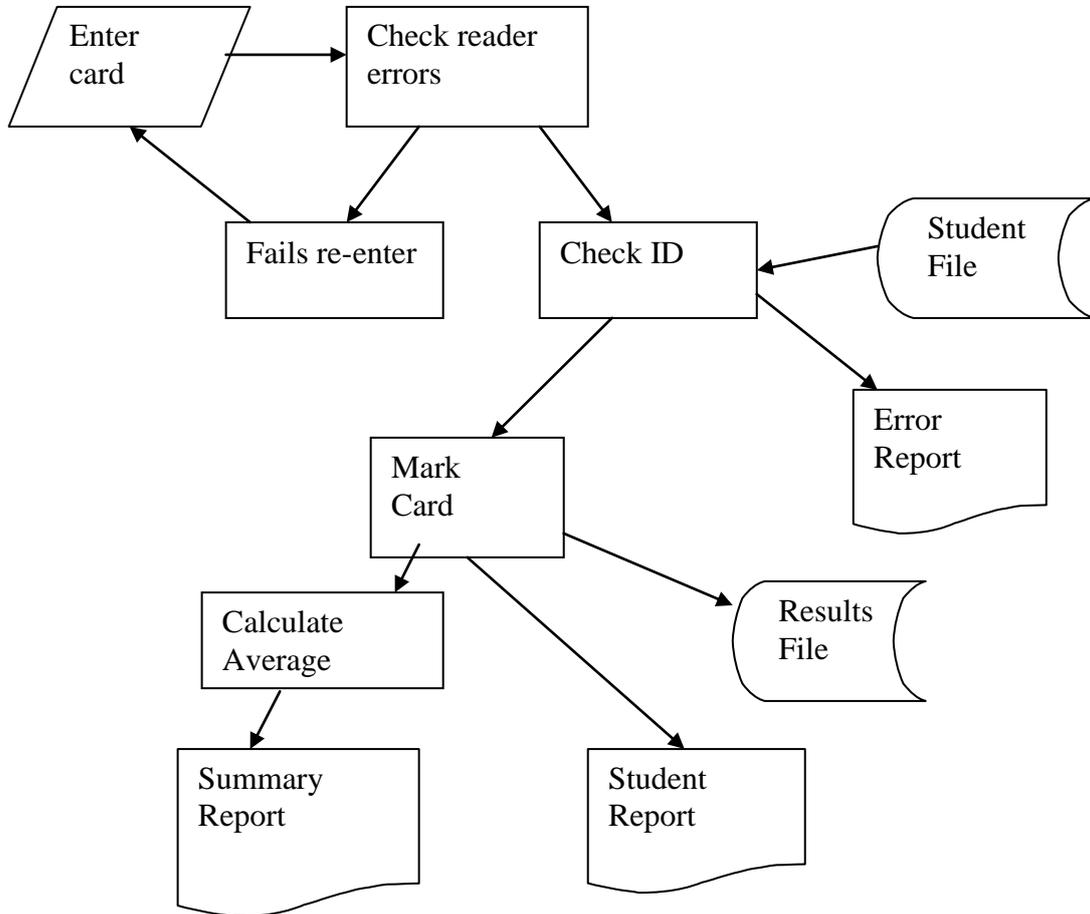
[2 marks]

(d) Award [1 mark] for each correct gate up to [2 marks max].



[2 marks max]

18. (a) Award marks for boxes in correct positions only: Award [1 mark] for marking card, [1 mark] for average calculation, [1 mark] for summary of student report, [1 mark] for Student report, [1 mark] for Results file.



[5 marks]

- (b) (i) direct access; [1 mark]
- (ii) record read directly [1 mark] and the ID and other details checked to confirm correct match [1 mark]. [2 marks]
- (c) sequential file organization. [2 marks]

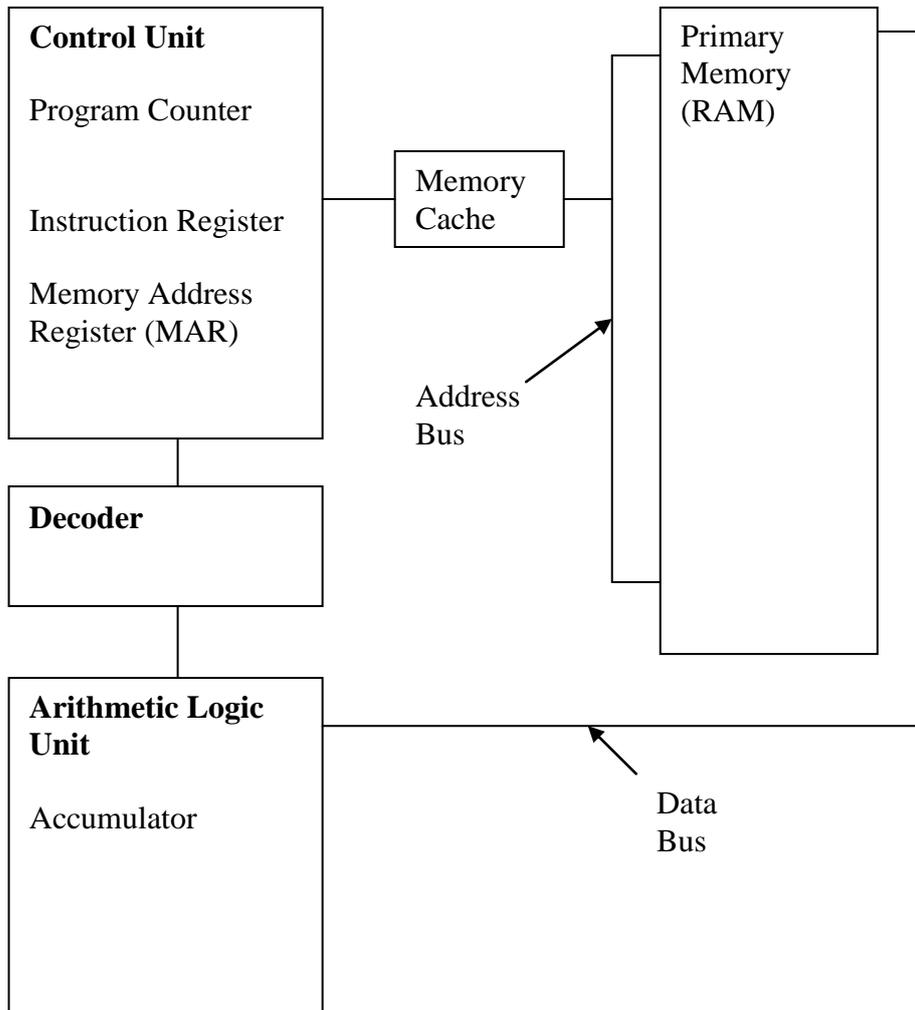
19. (a) Object created passing the cost;
Method carpetCost called and result displayed; *[2 marks]*
- (b) CalcCost c = new CalcCost(20);
Output(c.carpetCost(10, 20)); *[2 marks]*
- (c) *Award [1 mark] for each point up to [2 marks max].*

data/information hidden from outside object;
cannot be changed after object created – reduces errors;
can only be accessed via accessor method; *[2 marks max]*
- (d) *Award [1 mark] for each point up to [2 marks max].*

polymorphism allows the same form to be used;
form behaves according to the context;
context selected via pattern matching on parameters;
methods are selected via overloading; *[2 marks max]*
Accept, not specifically in course.
- (e) CalcCost c = new CalcCost(32);
Output(c.carpetCost(20)); *[2 marks]*

20. (a) Award marks as follows up to [4 marks max].
both Buses identified;
RAM;
accumulator in ALU;
reasonable location of CACHE and
PC and IR in the Control Unit.
note: decoder and MAR not required.

[4 marks max]



- (b) the role of the program counter is to hold the address of the next instruction to execute [1 mark].
it is automatically incremented [1 mark] to the next instruction but can be modified by a jump type instruction. [2 marks]
- (c) interrupts allow the current job of a CPU to be suspended temporarily [1 mark] to perform a higher priority task [1 mark]. [2 marks]
- (d) polling can be efficient use of CPU time;
polling can be used when CPU not busy; [2 marks]

21. (a) major threat is from hackers *[1 mark]* who will attempt to crack the remote login security and gain all rights administrator access *[1 mark]*.

can also come from poor customer practice of openly displaying login details at home or at work, fellow work colleagues watching your password *etc. [1 mark]*, allows others, not authorized, to access using your details *[1 mark]*. *[2 marks max]*

- (b) typical answer will state use of a firewall *[1 mark]* to allow inspection of the source of data packets or to separate the real environment from a proxy to limit the ease by which untrusted sources can attempt to access the real data on the real server.

Award [1 mark] for a reasonable attempt to qualify the suggestion.

firewalls do not protect against poor personal habits of securely using login names and passwords. Good customer education *[1 mark]* and/or companies requiring passwords to change regularly *[1 mark]*. *[2 marks max]*

- (c) organization needs to do two things: (a) constantly update the virus software *[1 mark]* and (b) educate users *[1 mark]*. *[2 marks]*

- (d) the server is a multi-user environment running a multi-user operating system *[1 mark]*, the operating system shares its time amongst the users *[1 mark]*. *[2 marks]*

- (e) user data protected via operating system when in RAM *[1 mark]* to prevent overwriting or accidental interchange *[1 mark]*. *[2 marks]*
-