

MARKSCHEME

November 2007

COMPUTER SCIENCE

Higher Level

Paper 1

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General Marking Instructions

*After marking a sufficient number of scripts to become familiar with the markscheme and candidates' responses to all or the majority of questions, Assistant Examiners (AEs) will be contacted by their Team Leader (TL). The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. It may be necessary to review your initial marking after contacting your TL. **DO NOT BEGIN THE FINAL MARKING OF YOUR SCRIPTS IN RED INK UNTIL YOU RECEIVE NOTIFICATION THAT THE MARKSCHEME IS FINALIZED.** You will be informed by e-mail, fax or post of modifications to the markscheme and should receive these about one week after the date of the examination. If you have not received them within 10 days you should contact your TL and IBCA. Make an allowance for any difference in time zone before calling. **AEs WHO DO NOT COMPLY WITH THESE INSTRUCTIONS MAY NOT BE INVITED TO MARK IN FUTURE SESSIONS.***

You should contact the TL whose name appears on your “Allocation of Schools listing” sheet.

Note:

Please use a personal courier service when sending sample materials to TLs unless postal services can be guaranteed. Record the costs on your examiner claim form.

General Marking Instructions

1. Once markscheme is received mark in pencil until final markscheme is received.
2. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED** once mark
3. Where a mark is awarded, a tick (✓) should be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark.
4. Sometimes, careful consideration is required to decide whether or not to award a mark. Indeed, another examiner may have arrived at the opposite decision. In these cases write a brief annotation in the **left hand margin** to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking.
5. Unexplained symbols or personal codes/notations on their own are unacceptable.
6. Record subtotals (where applicable) in the right-hand margin against the part of the answer to which they refer. Show a mark for each part question (a), (b), *etc.* Do **not** circle sub-totals. Circle the total mark for the question in the right-hand margin opposite the last line of the answer.
7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin.
8. **Section A:** Add together the total for the section and write it in the Examiner Column on the cover sheet.
Section B: Record the mark awarded for each of the six questions answered in the Examiner Column on the cover sheet.
Total: Add up the marks awarded and enter this in the box marked TOTAL in the Examiner Column on the cover sheet.
9. After entering the marks on the cover sheet check your addition of all marks to ensure that you have not made an arithmetical error. Check also that you have transferred the marks correctly to the cover sheet. **We have script checking and a note of all clerical errors may be given in feedback to all examiners.**
10. Every page and every question must have an indication that you have marked it. Do this by **writing your initials** on each page where you have made no other mark.
11. A candidate can be penalized if he/she clearly contradicts him/herself within an answer. Once again make a comment to this effect in the left hand margin.

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. Prototyping means designing a simpler model of a system;
in order to validate some of the functional requirements;
by involving end-users;

designing a partially working model of a system;

For example:
using special software to design user interface;
without processing behind it;
in order to evaluate, test or have it approved / checked by the user; [2 marks max]

2. Once the source code has been compiled into object code;
linker puts the appropriate machine/return addresses in all external calls;
so all the modules are linked to work properly; [2 marks max]

3. installation instructions;
machine requirements;
help/troubleshooting/online help/support;
user manual;
etc. [3 marks max]
Award [1 mark] for any relevant item.

4. instruction is fetched;
decoded;
executed;
and the result stored; [4 marks]
Award [1 mark] for each step in the given order.

5. possible answer:
While data is being deposited in one buffer, the processor can process data in the second buffer
[1 mark], and when it has finished processing it processes the data in the first buffer [1 mark],
while the second buffer is filled up [1 mark]. [2 marks max]
Accept as examples any I/O operation (like printing).

6. (a) A hardware generated signal [1 mark] that causes suspension of the execution of the program
[1 mark], which currently has control of the CPU [1 mark]. [2 marks]

(b) Special register in the CPU (interrupt register) [1 mark], in which each bit represents a
different type of interrupt [1 mark] is checked at the beginning of each fetch-execute cycle
[1 mark], and if a bit is set [1 mark] the current process is suspended [1 mark] and its state
saved [1 mark] and control passed to the appropriate interrupt handler [1 mark]. [4 marks max]

7. Award **[1 mark]** for each comparison.

batch processing	real time processing
data collected over period of a time	as requests for data manipulation occur
and processed later	they are immediately processed
all at the same time	one by one

[3 marks max]

8. (a) sequential files / serial files;
index sequential files (partially and fully index sequential files);
random/direct files;
Award **[1 mark]** for each correct.

[3 marks]

(b) searching;
sorting;
maintaining;
updating (inserting, modifying, changing, deleting);
etc.
Award **[1 mark]** for any.

[2 marks]

9. Award **[4 marks max]**, if student doesn't show working out but s/he shows output only then award **[2 marks max]**.

output: 1 2 1 2

call 1 n=2

a='1' b='2' output 1 **[1 mark]**

call2 n=1

a='2' b='1' output 2 **[1 mark]**

call 3 n=0

call 3 terminates **[1 mark]**

output 1 **[1 mark]**

call 2 terminated

output 2 **[1 mark]**

call 1 terminates

[4 marks max]

10. possible answers:

bar codes are cheap and easy to print;

bar codes can be easily read by hand held scanner by someone walking/driving round the store;

can be attached to an item in the process of manufacture and read at every production stage;

etc.

[2 marks]

Award **[1 mark]** for each reason.

11. (a) Advantages:
a lot of information can be stored on the card;
easy way to have all data available wherever you are;
could be used as an identity/cash card;
- Disadvantages:
could be lost/destroyed/contain sensitive data which could be misused;
cannot be read without special equipment; **[2 marks max]**
Award **[1 mark]** for advantage, **[1 mark]** for disadvantage.
- (b) special equipment should be widely installed to read the cards;
cards should be cheap / robust;
cards should be secure against fraudulent use;
the card should be easily replaceable in case that the card is lost or accidentally destroyed;
Award **[1 mark]** for each. **[2 marks max]**

12. Award **[3 marks max]**, **[1 mark]** for all correct input combinations, **[1 mark]** for each output column (2), and **[1 mark]** for stating that they are not equivalent).

A	B	$A \cdot \bar{B}$	$\bar{A} + \bar{B} \cdot A$
0	0	0	1
0	1	0	1
1	0	1	1
1	1	0	0

They are not equivalent because output columns differ. **[3 marks max]**

SECTION B

[60 marks]

- 13.** (a) Putting a list;
in (ascending or descending) order; **[2 marks]**
- (b) Locating a specific value (target);
in a list of values; **[2 marks]**
- (c) *Award [2 marks], [1 mark] for name, [1 mark] for BigO notation.*
possible answers (sorts listed in the syllabus, accept other sorts):
bubble sort $O(n^2)$;
selection sort $O(n^2)$;
quick sort $O(n \log_2 n)$; **[2 marks max]**
- (d) *Award [2 marks], [1 mark] for name, [1 mark] for BigO notation.*
possible answers (algorithms listed in the syllabus);
linear/sequential search $O(n)$;
binary search $O(\log_2 n)$; **[2 marks]**
- (e) *Award [2 marks] for correct explanation, [1 mark] for vague answer.*
example answer:
sorts can be avoided by maintaining the data in correct order all the time (example linked list)
or
sorts can be avoided by keeping the items in a data structure such as a BST. **[2 marks]**

14. (a) Award [2 marks max], [1 mark] for each.
personal computer;
communication-modem, telephone lines, ISDN, ADSL; [2 marks max]

- (b) Award [2 marks max], [1 mark] for any of advantage to company, [1 mark] for any advantage to customer.

Advantage to company:
better stock control;
fast/easy sale analysis;
reduces paperwork;
etc.

Advantage to customer:
fast response to orders;
quick searching/comparing prices;
etc.

[2 marks max]

- (c) Award [1 mark] each for each of the following up to [4 marks max].
data is broken up into packets;
packet contains source / destination address;
packet contains sequence / packet number;
dispatched by any route / (different routes);
reassembled at destination;

[4 marks max]

- (d) Award [2 marks max], [1 mark] for each comparison.
possible answers:

Serial transmission	Parallel transmission
one bit transmitted at a time	many bits transmitted simultaneously down individual wires
data can be sent over longer distances	short distances
slower transmission rates	faster

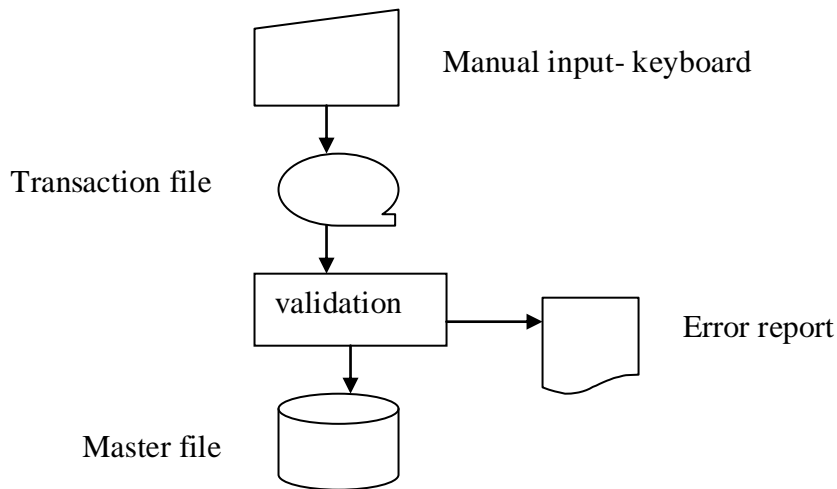
[2 marks max]

15. (a) Award **[3 marks max]**, **[1 mark]** for each field.

```
public class TransData
{ String accNo;
  String description;
  double value; (accept float or an other numeric format)
}
```

[3 marks]

- (b) Award **[4 marks max]**, **[1 mark]** for each labeled flowchart symbol.



[4 marks]

- (c) transaction file contains details of all transactions in a period of the time **[1 mark]** and after processing the data in the file can be discarded **[1 mark]**.

whilst

master file is permanent **[1 mark]**, kept up to date by applying transactions that occur **[1 mark]**. **[3 marks max]**

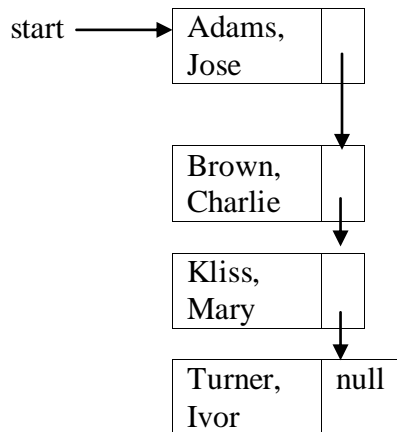
16. (a) Award **[1 mark]** for correct column STUDENT'S NAME, **[2 marks]** for correct column NEXTSTUDENT (**[1 mark]** for each changed link), **[1 mark]** for correct pointer nextAvailable. **[3 marks max]**

start	<input type="text" value="0"/>		
nextAvailable	<input type="text" value="5"/>		
	0	STUDENT'S NAME	NEXT STUDENT
	1	Adams, Jose	3
	2	Turner, Ivor	-1
	3	Kliss, Mary	4
	4	Brown, Charlie	2
	5	Lohy, Ann	1
	6		6
	7		7
	·		
	99		-1

- (b) Award **[1 mark]** for correct column STUDENT'S NAME (name Kliss Mary may not appear on the list).
Award **[2 marks]** for correct column NEXTSTUDENT (award **[1 mark]** for each changed link).
Award **[1 mark]** for correct pointer nextAvailable). **[3 marks max]**

start	<input type="text" value="0"/>		
nextAvailable	<input type="text" value="2"/>		
	0	STUDENT'S NAME	NEXT STUDENT
	1	Adams, Jose	3
	2	Turner, Ivor	-1
	3	Kliss, Mary	4
	4	Brown, Charlie	1
	5		5
	6		6
	7		7
	·		
	99		-1

(c)



Award [1 mark] for any.

pointer to the first node in the list;

correct node contents (data and link);

correct order of nodes;

all correct links and null;

although pointer nextAvailable is not needed in dynamic representations, marks are to be awarded for the following statements.

stating that nextAvailable could be a pointer to last node;

or if ADT linked list is used-add a node at the end of the list is available method so pointer

nextAvailable is not needed;

[4 marks max]

17. (a) possible answer:
depending on the type of forms handwritten or marked by a member (tick boxes) should include one of the following
- keyboard input/terminals
optical mark recognition **[2 marks]**
- (b) for example:
data could be inputted second time and compared with what is already stored on the file (verification);
the range/ type of inputted data could be validated; **[2 marks]**
Award [2 marks] for any example of data verification or validation.
- (c) (i) during program maintenance phase some errors might appear-modification of the code if needed. **[2 marks]**
- (ii) error detection - by transmitting parity bit with each character and check sum with each block. **[2 marks]**
- (iii) *Award [2 marks max] for any of the following.*
user manual should contain clear set of instructions;
users/operator should carefully follow the instructions;
to avoid using incorrect/old files
or updating master file using incorrect transaction file;
etc. **[2 marks]**

18. (a) (i) the binary system uses only two digits (0 and 1);
and computer uses 'bi-stable' devices which can be either on or off;
and magnetic storage devices are able to use magnetic fields of two polarities (north and south);
etc. [2 marks]
Award [1 mark] for each valid point.
- (ii) easy to convert from binary to hex;
more convenient to read / write digits in hex than a string of binary digits; [1 mark]
- (b) (i) $F0A_{(16)}$; [1 mark]
- (ii) $1101000111_{(2)}$; [1 mark]
- (c) MANTISSA
sign bit 0 \mapsto positive mantissa; [1 mark]
 $0.1_{(2)} = 0.5_{(10)}$; [1 mark]
- EXPONENT
sign bit 1 \mapsto negative exponent;
two's complement 111111 \mapsto 000001;
 $-1_{(2)} = -1_{(10)}$;
- DECIMAL EQUIVALENT: $0.5_{(10)} \times 2^{-1} = 0.25_{(10)}$; [5 marks max]
-