

# **MARKSCHEME**

**November 2005**

## **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) by telephone. 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 Team Leader by telephone. 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. Follow the markscheme provided, do **not** use decimals or fractions and mark only in **RED**.
2. 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.
3. 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.
4. Unexplained symbols or personal codes/notations on their own are unacceptable.
5. 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.
6. Where an answer to a part question is worth no marks, put a zero in the right-hand margin.
7. **Section A:** Add together the total for each question and write it in the Examiner Column on the cover sheet.  
**Section B:** Record the mark awarded for each of the four 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.
8. 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.**
9. 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.
10. If a candidate has attempted more than the prescribed number of questions, mark only the required number of answers in the order in which they are presented in the script and ignore any excess material, regardless of its quality. Make a comment to this effect in the left hand margin. **This is unless the candidate indicates otherwise on the cover sheet.**
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 any 4 questions (10 marks each). Total 40 marks.  
Maximum total = 80 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 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.
- The order of points does not have to be as written (unless stated otherwise).
- 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**

1. (a) Award [1 mark] for any of the following up to [2 marks max].

CD ROM	hard disk
capacity ~600 MB	20 GB and more;
removable	fixed;
is read only	contents can be altered many times;
optical	magnetic;
etc.	etc.

[2 marks max]

- (b) Award [1 mark] for any of the following up to [2 marks max].

holding software;  
 holding an encyclopedia;  
 holding music;  
 holding pictures;  
 etc.

[2 marks max]

2. Award [1 mark] for any explanation that the analysis/design stage is separate from implementation (programming). This may be implied and not stated explicitly.

Award [1 mark] for any explanation of the need to change the software as user needs change, and thus the cycle from design to programming then back to redesign then back to reprogramming.

[2 marks]

3. Award [2 marks] for correct answer, [1 mark] for a vague answer.

Example answer: scope of an identifier includes the program block in which the identifier is declared and all the blocks included within it.

The areas of computer program where identifiers might be accessed.

[2 marks]

4. Award [2 marks] for correct answer, [1 mark] for a vague answer.

Example answer: when object code is created (after compiling) all separate subprograms have to be linked to the object code. Linker puts the appropriate machine addresses in all external calls so the modules are linked together.

[2 marks]

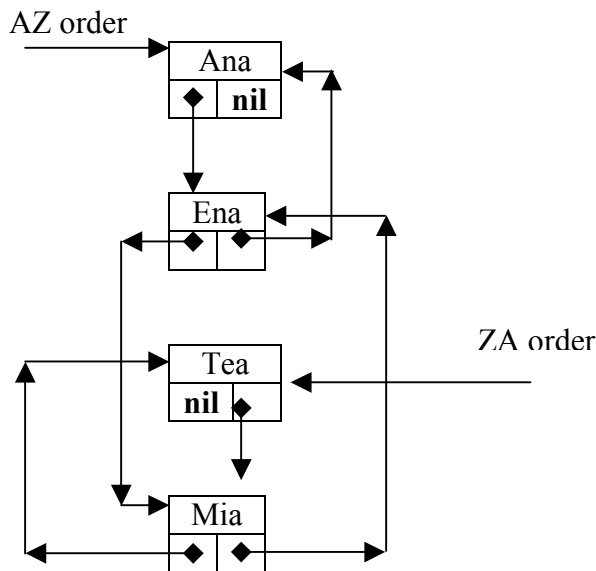
5. Award [1 mark] for any of the following points up to [3 marks max].

bubble sort compares adjacent array elements;  
 and exchanges them if they are out of order;  
 the process is repeated until the entire array is examined;  
 without any changes being made;

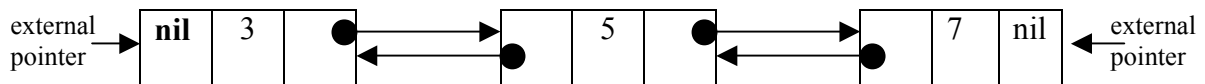
[3 marks max]

6. Award marks as following up to **[3 marks max]**.  
**[1 mark]** for showing two external pointers;  
**[1 mark]** for showing two NIL fields;  
**[1 mark]** for all correct internal links;  
**[2 marks]** for showing that each node contains at least 3 fields- 1 data field and two pointers.

Example drawing:



OR



**[3 marks max]**

7. Award **[1 mark]** for any of the following up to **[2 marks max]**.  
 observation;  
 reading all associated documentation;  
 interviews;  
 questionnaires; **[2 marks max]**
8. (a) Central Processing Unit, where the processing of instructions takes place. **[2 marks]**  
 (b) Word size means the number of bits the CPU can process simultaneously. **[2 marks]**
9.  $23_{10} = 10111_2$
- (i)  $00010111$ ; **[1 mark]**  
 (ii)  $11101001$ ; **[1 mark]**

10. Award **[2 marks]** for correct answer, **[1 mark]** for a vague answer.  
Example answer: a technique for allowing devices to determine/check the status of another device, at regular intervals. **[2 marks]**

11. Set of rules that devices understand when they communicate with each other. **[2 marks]**

12. Award **[3 marks]** for all 4 input combinations and all 4 correct output values.  
**[2 marks]** for 3 correct input and output combinations.  
**[1 mark]** for 2 correct combinations.

A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

**[3 marks]**

13. Award **[1 mark]** for an application and **[1 mark]** for a short explanation.

Possible answers:

- security, video control
- iris detection, (airport)
- entertainment (making movies, pictures)
- web cameras
- video conferencing
- etc.*

**[2 marks]**

14. A modem is a device that converts digital signals into analog signals and vice versa. **[2 marks]**



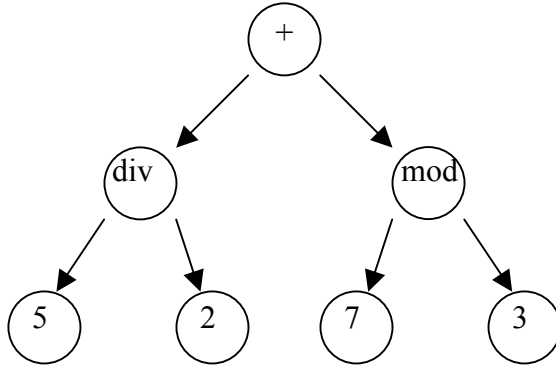
15. (a) 3;

[1 mark]

(b) Award [2 marks] for correct answer, [1 mark] for a minor error.  
5 2 div 7 3 mod +.

[2 marks]

(c) Award [2 marks] for correct answer, [1 mark] for a minor error.



[2 marks]

**SECTION B**

16. (a) *Award [1 mark] for any of the following up to [3 marks max].*  
delays, the users had to wait for days for their projects to be completed;  
it is difficult to allocate the cost of computer processing facility to many different departments;  
communication costs become high when company's departments are spread over many different locations;  
computer specialists responsible for the design of computer applications ended up being responsible for working in many areas with which they were unfamiliar;  
*etc.* **[3 marks max]**
- (b) *Award [1 mark] identification of the benefit and [1 mark] for elaboration up to [4 marks max].*  
the users are more directly involved in the processing activities.  
computer processing costs are easier to allocate to different departments.  
the computer staff are more familiar with the activities and needs of the specific department they support.  
less expensive communications / internal communications / e-mail.  
processing activities are faster and easier to control and coordinate.  
*etc.* **[4 marks max]**
- (c) *Award [1 mark] for any of the following up to [3 marks max].*  
*If only integrity or only security award [2 marks max].*  
give users passwords;  
encrypt data before transmitting;  
monitor employees carefully;  
back up all data;  
store back ups away from the computer sites;  
locate computers away from locations where equipment may be damaged;  
*etc.* **[3 marks max]**

17. (a) a file is an organized collection of data/records. **[2 marks]**

(b) *Award [1 mark] for any of the following up to [2 marks max].*

- how the file is to be used;
- how many records are processed at one time;
- how quickly records need to be accessed;
- etc.*

**[2 marks max]**

(c) (i) *Award [1 mark] for any of the following up to [2 marks max].*

- serial file organization;
- sequential file organization;
- partially indexed file organization;
- fully indexed file organization;
- direct access file organization;

**[2 marks max]**

(ii) *For any of the file organizations, award [1 mark] up to [4 marks max] for any of the points listed below.*

Possible answers:

Serial organization:

- records on a serial file are not in order;
- so a particular record can be accessed by reading through the whole file starting at the beginning of the file;
- until the right record is located;
- transferred to RAM from where it can be fetched;
- all needed operations performed (modification);
- contents of record can be directly overwritten by the new modified record;

Sequential organization:

- records are stored in order;
- to access a particular record each record must be read starting from the beginning until the right record is located;
- transferred to RAM from where it can be fetched;
- all needed operations performed (modification);
- contents of record can be directly overwritten by the new modified record;

Direct organization:

- the address/location of a particular record to be accessed is calculated and then the record is directly accessed/modified
- or** transferred to RAM from where it can be fetched;
- all needed operations performed (modification);
- contents of record can be directly overwritten by the new modified record;

Partially-indexed organization:

index is a sequential file so the first record in the group (where a particular record belongs) is sequentially searched;

when found the first record in the group is directly accessed in the data file;

and then a desired record is sequentially searched;

when found/located;

transferred to RAM from where it can be fetched;

all needed operations performed (modification);

contents of record can be directly overwritten by the new modified record;

Fully-indexed:

index is sequentially searched;

and then a desired record is directly accessed in the data file;

transferred to RAM from where it can be fetched;

all needed operations performed (modification);

contents of record can be directly overwritten by the new modified record;

*[4 marks max]*

18. (a) (i) *Award [2 marks] for a correct explanation, [1 mark] for a vague answer.*  
no interaction between the user and computer, one or more programs are submitted to the computer and put in a queue until it is their turn to be run. **[2 marks]**
- (ii) *Award [2 marks] for a correct explanation, [1 mark] for a vague answer.*  
input data must be processed immediately- quick respond is required. **[2 marks]**
- (b) (i) real time processing; **[1 mark]**
- (ii) batch; **[1 mark]**  
*Accept online, interactive.*
- (c) *Award [2 marks] for any description that includes one user able to switch between several tasks (at the same time), [1 mark] for a vague answer.* **[2 marks]**
- (d) interactive – (online) – the device used for data entry is connected to the computer which will process it;  
batch – (offline) – data collected, then inputted to a computer (sometimes not the computer that will process the data), stored on a backing storage media and then later processed (on this or any other computer); **[2 marks]**

19. (a) *Award [2 marks] for a correct definition, [1 mark] for a vague answer.*  
a data structure in which items may be added only at one end called rear/tail/back and removed only at the other end called front/head. **[2 marks]**
- (b) (i) *Award [2 marks] for a correct explanation, [1 mark] for a vague answer.*  
array size is fixed and frequently the back of the queue reaches the end of the array when the queue is not yet full (there may be still space available at the beginning of the array). **[2 marks]**
- (ii) *Award [1 mark] for each step in this order up to [3 marks max].*  
create a node;  
fill its data fields;  
place the value of NIL in its link field;  
link the node to the last node in the queue;  
change the rear pointer so it points to the new node (current last node in the queue); **[3 marks max]**  
*Accept a diagram if provided.*
- (c) (i) *Award [2 marks] for a correct explanation/drawing, [1 mark] for a vague answer.*  
Example answer: a list that has a single pointer that connects both its head and its back. **[2 marks]**
- (ii) only a single pointer needs to be maintained when inserting and deleting nodes; **[1 mark]**

20. (a) (i) *Award [1 mark] for each correct call up to [4 marks max].*  
 For each call current values of bounds and array elements should be shown.

Example answer:

**Call 1** B1=1

B2=6

After SWAP (NAMES [1], NAMES [6]) array contents is as follows:

Pia	Ena	Eva	Mia	Tea	Ana
-----	-----	-----	-----	-----	-----

**Call 2** B1=2

B2=5

After SWAP (NAMES [2], NAMES [5]) array contents is as follows

Pia	Tea	Eva	Mia	Ena	Ana
-----	-----	-----	-----	-----	-----

**Call 3** B1=3

B2=4

After SWAP (NAMES [3], NAMES [4]) array contents is as follows

Pia	Tea	Mia	Eva	Ena	Ana
-----	-----	-----	-----	-----	-----

**Call 4** B1= 4

B2=3

**Call 4 terminates**

**Call 3 terminates**

**Call 2 terminates**

**Call 1 terminates**

*[4 marks max]*

- (ii) the algorithm reverses the array elements between the two bounds (B1 and B2).  
*[2 marks]*

- (b) (i) *Award [2 marks] for a correct explanation, [1 mark] for a vague answer.*  
 parameter passing means passing the variable contents (values) or addresses (references) between the calling subprogram and the called subprogram. *[2 marks]*

- (ii) *Award [2 marks] for any correct advantage, [1 mark] for a vague answer.*  
 subprograms uses variable names which are independent of those in the main program.

same instructions can be performed on different variables by calling it with different parameters.

*etc.*

*[2 marks]*