



MARKSCHEME

November 2004

COMPUTER SCIENCE

Higher Level

Paper 1

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If you do not have a copy of the current Computer Science Guide,
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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.

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 [2 marks] for any one of these.*
possible answers:
meteorology- collecting data on temperature, wind speed, humidity, etc.
automatic door control
vehicle detectors, control of entry into car park
burglar alarms - signals when doors or windows are open
etc. **[2 marks]**
Award [1 mark] only for a vague answer.
- (b) Computers are digital devices and signals from sensors are analog values so AD converter is needed. **[2 marks]**
Award [1 mark] for stating computer is digital.
Award [1 mark] marks for describing any process which changes from analog to digital, such as sampling, etc.
2. (a) -27 **[2 marks]**
- (b) logic error; **[1 mark]**
- (c) A compiler forces some types of errors (syntax errors, type mismatches) to be corrected before the program, whereas an interpreter starts running the program without this check **[1 mark]** so when an interpreter encounters a syntax or type-mismatch error, the program stops running (a run-time error) **[1 mark]**. **[2 marks]**
3. (a) $O(N^2)$; **[1 mark]**
- (b) For example:
When a file is too large to fit in the primary memory **[1 mark]**, internal sorts cannot be used then external sorting (combination of merging and sorting) is required **[1 mark]**. **[2 marks max]**
4. *Award [2 marks] for answers that include connecting devices and exchanging signals between them.*
 - is a protocol used to control data transfer.
 - is a procedure by which two devices communicate checking whether the other is ready to receive data.
 - is procedure of exchanging predetermined signals when 2 devices communicate etc.**[2 marks]**
Award [1 mark] only for a vague answer.
5. (a) Rules for writing the statements. **[2 marks]**
- (b) Meaning of the statements. **[2 marks]**

6. (a) is a register in which each bit represents a different type of interrupt **[1 mark]**. It is checked at the beginning of each fetch-execute cycle and if a bit is set then the OS passes that information to the specific interrupt handler **[1 mark]**. **[2 marks]**
- (b) interrupts are assigned a priority **[1 mark]** (for example I/O operations are given high priority, calculations are given low priority)
 Once other interrupt is received the OS
 -disables it if it is of lower priority than the current one and it remains pending; **[1 mark]**
 -enables it if it is of higher priority than the current interrupt and the processor allows the enabled interrupt to occur; **[1 mark]**
 -disables it if it is of the same priority as the current interrupt, completes the current one and then the other one will be enabled (sometimes ignored); **[1 mark]**
[3 marks]
7. Award **[1 mark]** for showing that each array element/*node*/ consists of three fields: left and right pointer/index/ and data item
 For showing that variable tree points to the root/*tree variable holds subscript of the array element with value MONTEVIDEO*/
 Award **[2 marks]** for all correct left links; **[1 mark]** for minor error
 Award **[2 marks]** for all correct right links; **[1 mark]** for minor error
 Award **[1 mark]** for all correct data items. **[5 marks max]**

Tree = 1

| | Index | Left | Data | Right |
|------|-------|------|------------|-------|
| Tree | 1 | 2 | Montevideo | 5 |
| | 2 | 3 | Cardiff | 4 |
| | 3 | 0 | Auckland | 0 |
| | 4 | 0 | Houston | 0 |
| | 5 | 0 | Nairobi | 6 |
| | 6 | 0 | Tokyo | 0 |

"0" INDICATES NIL POINTER

-1 is acceptable, but they must not write "nil" in the arrays.

8. (a) LAN advantages
Award [1 mark] for any one of these.
 better privacy;
Accept security.
 faster access; *[2 marks]*
Accept if it is justified: more storage available or cheaper storage.
Do not accept easier to share, can read and write.

Award [1 mark] for correctly justifying/explaining the statement.
- LAN disadvantages
Award [1 mark] for any one of these.
 limited availability (not world-wide); *[2 marks]*
Accept if well justified: the LAN as a whole is expensive, so if student is only user, then web-storage is cheaper overall.

Award [1 mark] for correctly justifying/explaining the statement. *[4 marks max]*
- (b) *Award [1 mark] for any suitable removable storage device (diskette, USB stick, CD-R, tape...).*
Award [1 mark] for outlining how the device is used.
- For example:
- “Files are copied onto the diskette, the disk is taken to the other LAN, and the files are copied from the diskette onto a PC”.* *[2 marks max]*
9. *Award [1 mark] for a vague answer, [2 marks] for a complete answer.*
- larger file size longer it takes to send via the Internet – more money spent on phone calls;
 -web pages containing pictures, videos- takes long time to be loaded, so web designers reduce their size (use JPEP,MPEX,MP3);
 etc. *[2 marks]*
10. (a) *Award [2 marks] for any of the following with short examples.*
 storing parameters
 handling interrupts
 evaluating expressions
 storing subprogram’s return addresses
 etc. *[2 marks]*
- (b) *Award [2 marks] for any of the following with short examples.*
 job queues (priority queue)
 print documents one by one in order
 simulating customers queues
 etc. *[2 marks]*

SECTION B

11. (a) (i) 1 kB=1024 bytes; **[1 mark]**
 (ii) 1 MB=1024 kB=(1048576 bytes); **[1 mark]**
 (iii) 1 GB = 1024 MB=1024*1024kB=(1073741824bytes); **[1 mark]**

(b) For each task award **[1 mark]** for device, **[1 mark]** for reason.

- (i) possible answers:
- Device: floppy disk OR USB stick;
 - Reason: cheap, used everywhere, light, fits in a pocket;
- OR
- Device: CD-R;
 - Reason: cheap, today most people have a CD-R to write, possible to add data/write to CD-R in more than one session, stores more data than diskette;
- OR
- Device: removable drives;
 - Reason: removable, portable, relatively cheap, stores more data than floppy disk;
- [2 marks max]**

- (ii) possible answers: **[1 mark]** for a device, **[1 mark]** for a justification.
- Device: CD-ROM / CD-R;
 - Reason: stores large amount of data, relatively cheap to produce – especially for a large number of CD-ROMs, it is read only so data cannot be changed or deleted;
- [2 marks]**

- (iii) possible answers: **[1 mark]** for a device, **[1 mark]** for a justification.
- Device: magnetic tape;
 - Reason: low cost, large capacity;
- [2 marks]**
[6 marks max]

(c) plotter; **[1 mark]**

12. (a) Award **[2 marks]** for all input combinations, **[1 mark]** for 6 or 7 combinations.
 Award **[2 marks]** for all 8 correct outputs, **[1 mark]** for 6 or 7 correct outputs.
[4 marks max]

| A | B | C | D |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

(b) $D = \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}C + ABC$

[2 marks]

(c) $D = \overline{A}B\overline{C} + \overline{A}BC + A\overline{B}C + ABC = \overline{A}B(C + \overline{C}) + AC(B + \overline{B}) ;$

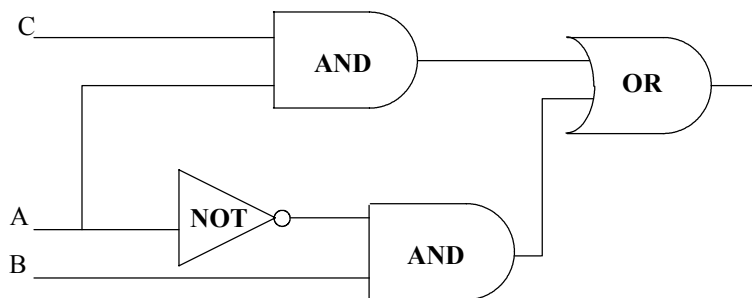
[1 mark]

$= \overline{A}B + AC ;$

[1 mark]

[2 marks]

(d) Award [2 marks] for correct drawing of a logic circuit that corresponds to the candidate answers to part c. [1 mark] for minor error (FT).



[2 marks]

13. (a) $403D_{(16)} = 0100000000/111101$; *[1 mark]*
 exponent $111101_{(12)}$ is $-3_{(10)}$; *[1 mark]*
 $403D_{(16)}$ is representation of 0.0625; *[1 mark]*
[3 marks]

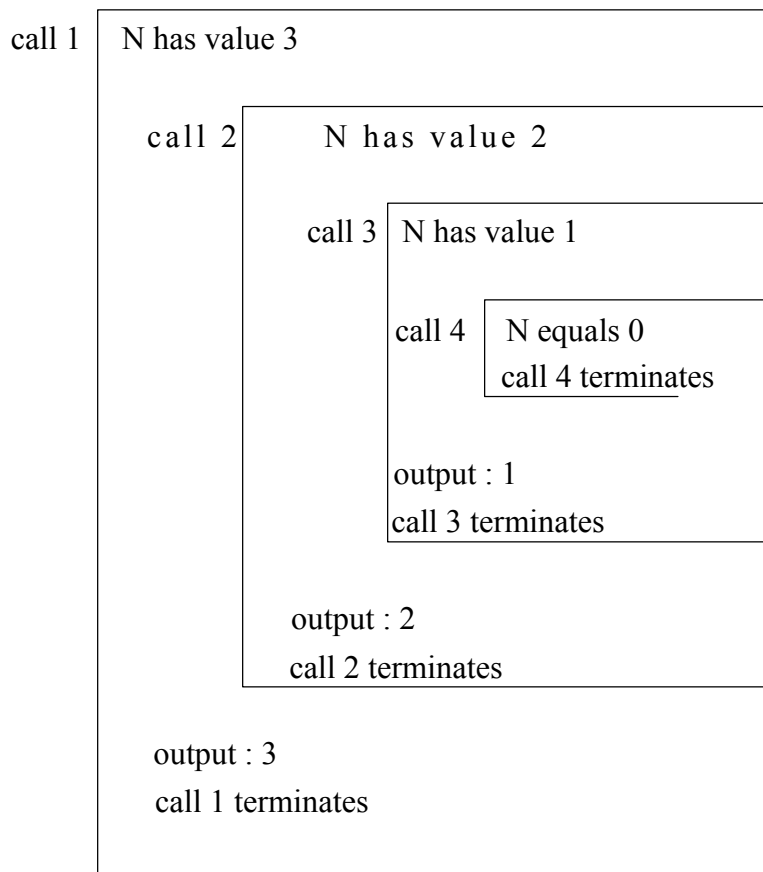
(b)

| | | | | | | | | | | | | | | | |
|------|---|----------|---|---|---|---|---|---|---|---|----------|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| sign | | mantissa | | | | | | | | | exponent | | | | |
| bit | | | | | | | | | | | | | | | |

Award [1 mark] for sign bit, [1 mark] for mantissa and [1 mark] for the exponent. [3 marks]

- (c) (i) error that occurs when number is too large to be stored, greater than the largest positive or smaller than the smallest negative number. *[2 marks]*
- (ii) error that occurs when number is too small for the range of the value representation being used. *[2 marks]*

14. (a) Is a process that calls itself **[1 mark]** and it has a terminating condition that must be reached after a finite number of calls **[1 mark]**. **[2 marks]**
- (b) Award **[1 mark]** for each of four calls. **[4 marks max]**



If only output “1 2 3” is shown award **[2 marks]** if correct.

- (c) Award **[2 marks]** for an advantage and **[2 marks]** for disadvantage **[1 mark]** for a vague answer. **[4 marks max]**

Disadvantage:

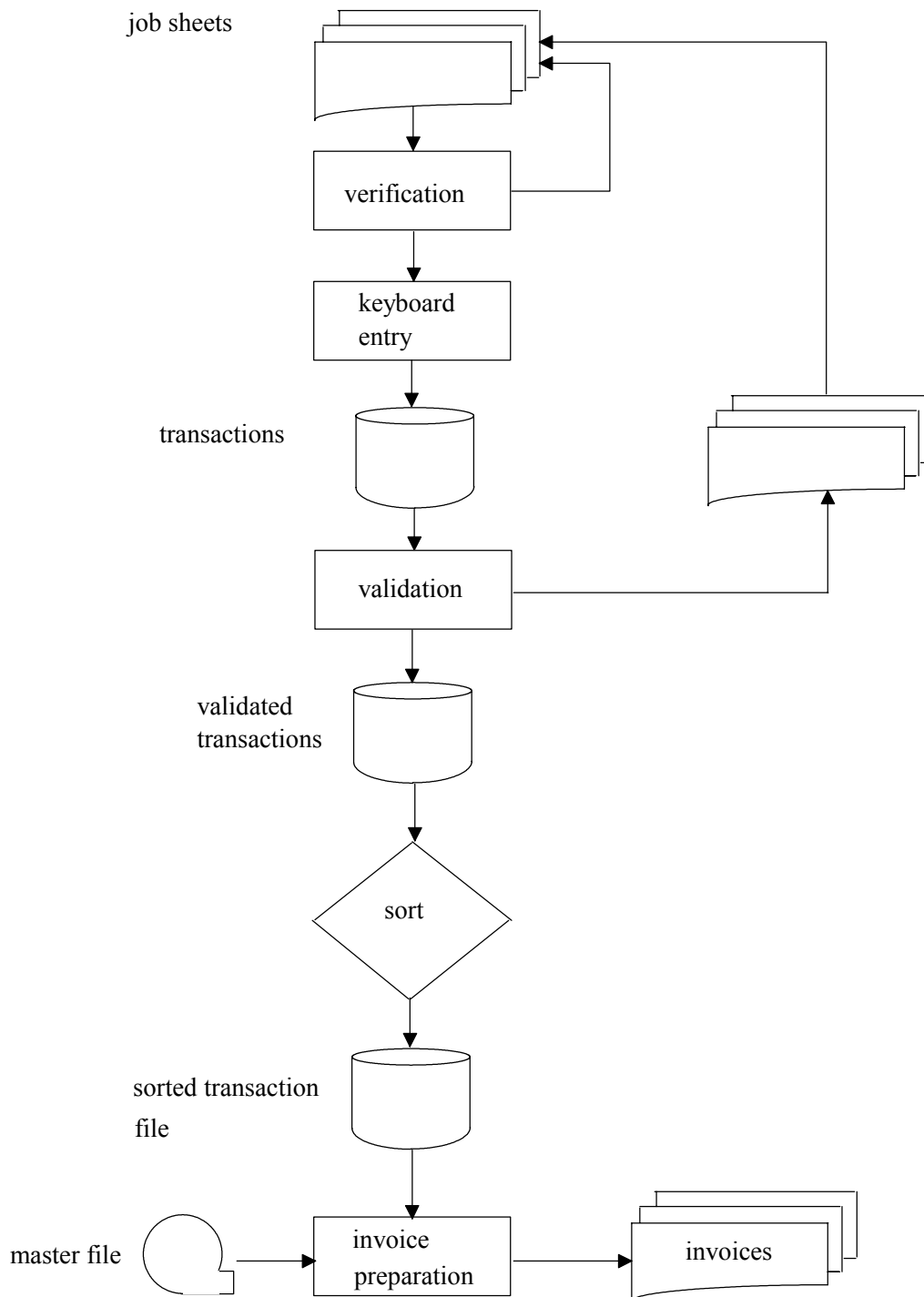
- Time and space consuming because of multiple recursive calls, for each call return addresses and copies of parameters and local variables are made.
- If recursion continues too long the stack containing return addresses may overflow and the program crashes.

Advantage:

- For some problems a recursion is more natural and easier for programmer to write (examples: tree traversals, towers of Hanoi).

15. (a) Award [1 mark] for any one of these up to [5 marks max].

verification;
 keyboard entry and storing data onto transaction file;
 validation;
 sorting transaction file;
 input from both files in preparation process;
 outputting of invoices;



Candidates are **not required** to use these symbols, they may use other boxes.

- (b) (i) When using sequential access records are accessed in order they are stored;
When searching for the nth record in a file it must read the first n-1 records in order to reach the nth;
Whereas when using direct access each record in the file can be accessed by referring its location within the file;
The nth record in the file can be found immediately without accessing any other records in the file;
- (ii) directly organized transaction file is sorted in the same order as sequentially organized master file to speed up the process (preparation of invoices).
otherwise to retrieve needed record from the master file all the preceding records must be read.

[4 marks]

[1 mark]
