

# **MARKSCHEME**

**November 2002**

**COMPUTER SCIENCE**

**Higher Level**

**Paper 1**

## 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 penalised. 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. In batch processing data recorded (manually) on source documents is gathered together in batches;  
and input all at one time;  
In on-line processing data is input immediately;  
and processed immediately; **[4 marks]**  
*Award [1 mark] for each valid point. Maximum [2 marks] for batch processing and maximum [2 marks] for on-line.*
  
2. A person speaks into a microphone connected to the computer;  
Spoken words (sound waves) are converted into computer usable form;  
The electrical patterns produced by the speakers' voice are compared with a set of pre-recorded patterns;  
If a matching pattern is found the computer executes the command; **[4 marks max]**  
*Award [1 mark] for each valid point.*
  
3. (a) 1 MHz = 1 million machine cycles per second; **[1 mark]**  
 (b) *Award [1 mark] for each up to a maximum of [4 marks].*  
 Retrieval of an instruction from memory;  
 And its subsequent decoding (the process of alerting the circuits in the microprocessor to perform the specified operation);  
 Incrementing program counter;  
 Execution of the instruction;  
 Storing the result; **[4 marks]**
  
4. (a) Perform a **range check**, for example rejecting any input which is not between 1 and 120. **[2 marks]**  
*Award [1 mark] for stating that a **range check** (or "size" check) is necessary, and [1 mark] for stating reasonable limits. Accept any reasonable limits - 5-100 or 21-65 (e.g. working adults). Award [0 marks] for "Ask the user for confirmation - e.g. Is this correct?"*  
 (b) *Award [2 marks] for any of the following:*
  - Search for the user's name in a data-file, and check that the age matches the age in the data-file;
  - Ask the user to type their birth date, calculate the correct age, and check that this matches the age typed by the user;
  - Ask the user to type the age again, and make sure the two versions match;
  - Ask the user to check (proofread) their input, e.g. with a message; **[2 marks]***Any other method which checks the age **against** some other data.*

5. *Award [1 mark] for each up to [2 marks].*  
Language translator that converts high-level language to machine code and executes those instructions;  
One instruction statement at a time; **[2 marks]**
6. *Award [1 mark] for each up to [2 marks].*  
Productivity is enhanced;  
Number of errors is kept to a minimum;  
Source code can be reused;  
Applications are easier to maintain *etc.*; **[2 marks]**
7. (a) 256 different colours; **[1 mark]**
- (b) *Award [2 marks] for one suitable application for example.*  
• When image is to be transmitted across network;  
• or stored on restricted medium;  
• many small images (thumbnails) are to be displayed on screen; **[2 marks]**
- (c) 4; **[1 mark]**
8. *Award [1 mark] for each up to [3 marks].*  
Defining the problem means to write the description of  
• the desired output;  
• the needed input;  
• the algorithm needed to obtain the output from the input;  
• identifying whether it is suitable for computer solution; **[3 marks]**
9. (a) *Award [1 mark] for each up to [3 marks].*  
Programs created by some programmers, usually by “hackers”;  
that consist of pieces of computer code (either hidden or posing as legitimate code);  
that when downloaded or run attach themselves to other programs or files and  
cause them to malfunction or other side effects;  
(are self replicating); **[3 marks]**
- (b) *Award [1 mark] for any valid point up to [2 marks].*  
• Buy updated versions of anti-virus software on a regular basis;  
• Run all disks obtained from another user through a virus checker program  
before using them;  
• Make back ups of data;  
• Be cautious with whom data is shared; **[2 marks]**

10. In normal scientific notation, kilo stands for  $10^3$ , which is a “round” number in decimal. In computers kilo stands for  $2^{10}$ , which is a “round” number in binary, very close to 1000.

*Award [1 mark] for a correct statement about binary **or** a correct statement about the decimal system. Award the 2nd mark for a correct statement about the other number system, which clearly identifies the difference between the two systems.*

*Award only [1 mark] for a statement like any of the following.*

- kilometre is in decimal, but kilobyte is in binary;
- a kilobyte is  $2^{10}$ , which is 1024, not 1000;

**[2 marks]**

*Award [0 marks] for a statement like:*

- computers don’t always calculate correctly

11.

line	P	K	I	I >= 4	output
1	1 (1)				
2		1			
3			1		
4		2			
5	$1 + \frac{1}{2}$ (1.5)				
6			2		
7				false	
4		4			
5	$1 + \frac{1}{2} + \frac{1}{4}$ (1.75)				
6			3		
7				false	
4		8			
5	$1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$ (1.875)				
6			4		
7				true	
8					1.875

**[5 marks]**

*Award [1 mark] for correct completion of each of the following.*

P, K, I, I >= 4, output.

*(i.e. [1 mark] for each correct column)*

## SECTION B

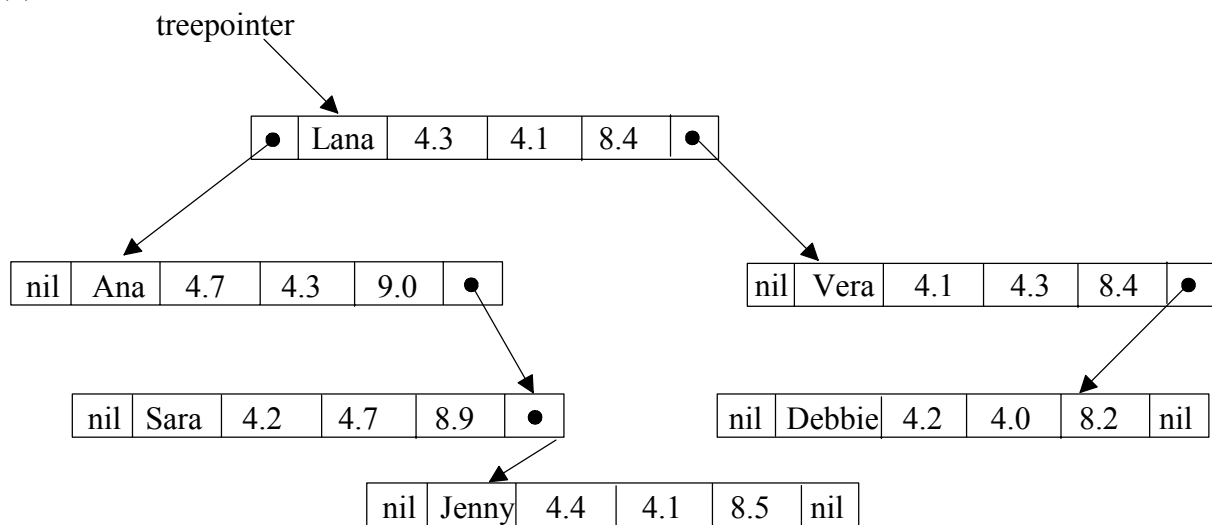
12. (a) **record**  
     NAME **string**  
     REQEL, PRES, TOTAL **real**  
**endrecord**

*[1 mark]* for record data type;

*[2 marks]* for correctly declared fields and their types, (*[1 mark]* for minor error) *[3 marks]*

*Accept a general description of the data structure if all data types clear.*

(b)



*[1 mark]* for Lana at root;

*[1 mark]* for Jenny higher than Vera;

*[2 marks]* for everything else correct;

*[4 marks]*

*Accept mirror image of tree diagram.*

(c) Award *[1 mark]* for identifying a characteristic and *[2 marks]* for a valid comparison. Statements must be valid comparisons between the two methods. Maximum of *[1 mark]* if there is no element of comparison.

For example:

insertion: tree is faster than linked list;

searching: tree is binary, linked list and sequential;

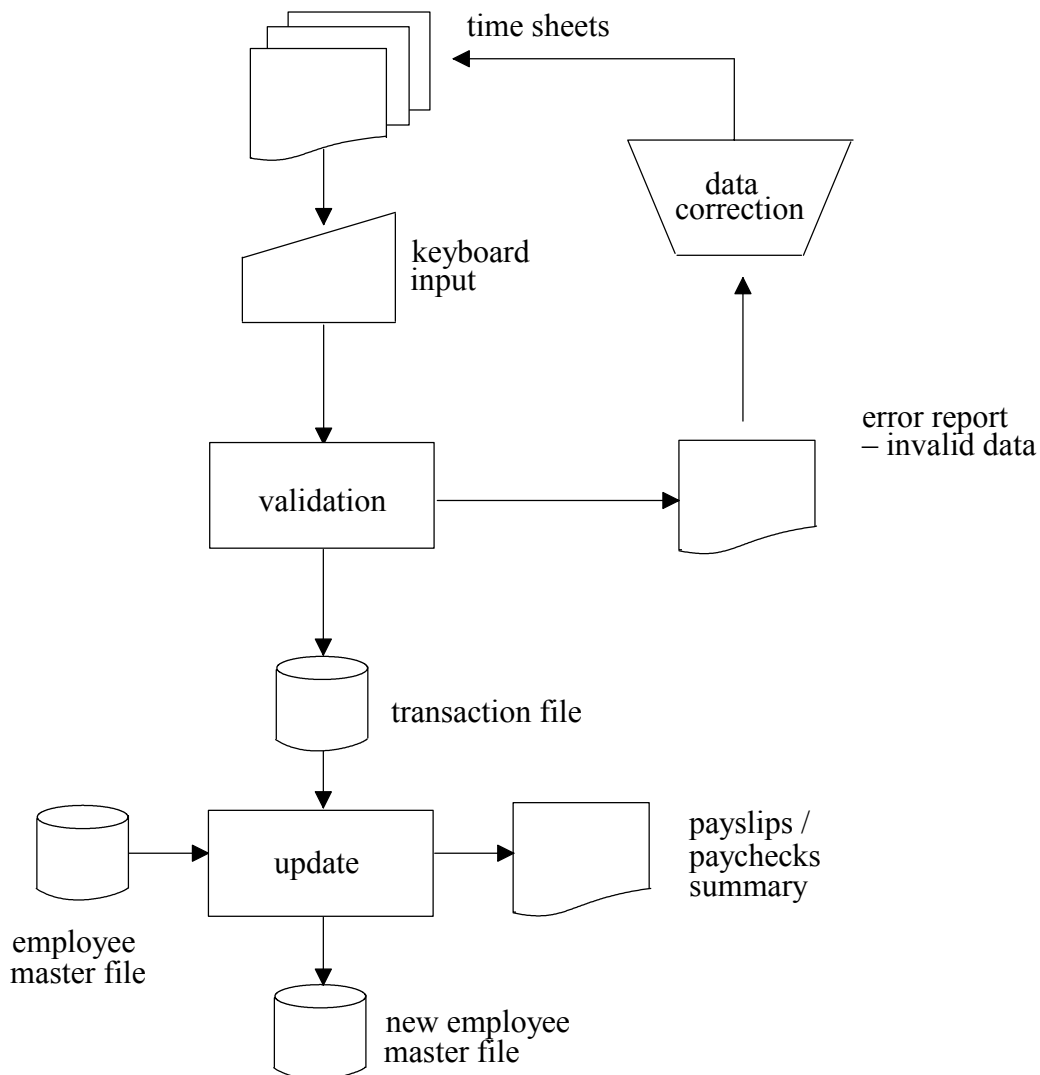
storage requirements: binary requires 2 pointers, linked list 1 pointer;

*[3 marks]*

13. (a) Seek time;  
The time it takes to position the read / write heads over the proper track; *[2 marks]*
- Rotational delay or latency;  
The time it takes for the correct sector to rotate over the read / write heads; *[2marks]*
- Data transfer time;  
The time it takes to transfer the data or instructions from the disk to RAM; *[2 marks]*
- [6 marks max]*
- (b) (i) For example:
- Primary to hold program during execution;  
Secondary to store data files, *etc.*; *[2 marks]*
- (ii) Because access time is fast: Primary;  
To hold data files permanently (secondary); *[2 marks]*

14. (a) (i) User documentation that describes the various functions the software performs, menus, input, output *etc.*;  
 Technical documentation – describes the hardware configuration needed, how to install software, *etc.*;  
 Operating instructions – to help users to learn how to use software; **[4 marks]**  
*Award [2 marks] for each, up to [4 marks].*
- (ii) Testing the software using valid and invalid data – comparing results with the manually produced results **[2 marks]**; **[2 marks]**

(b)



*Award [1 mark] for each of the following up to a maximum of [4 marks].*

- timesheets input via keyboard and validated;  
 error report and re-input if fails validation;  
 data input to transaction file;  
 transaction file **and** master file input to update process;  
 new master file **and** paychecks output from update process;

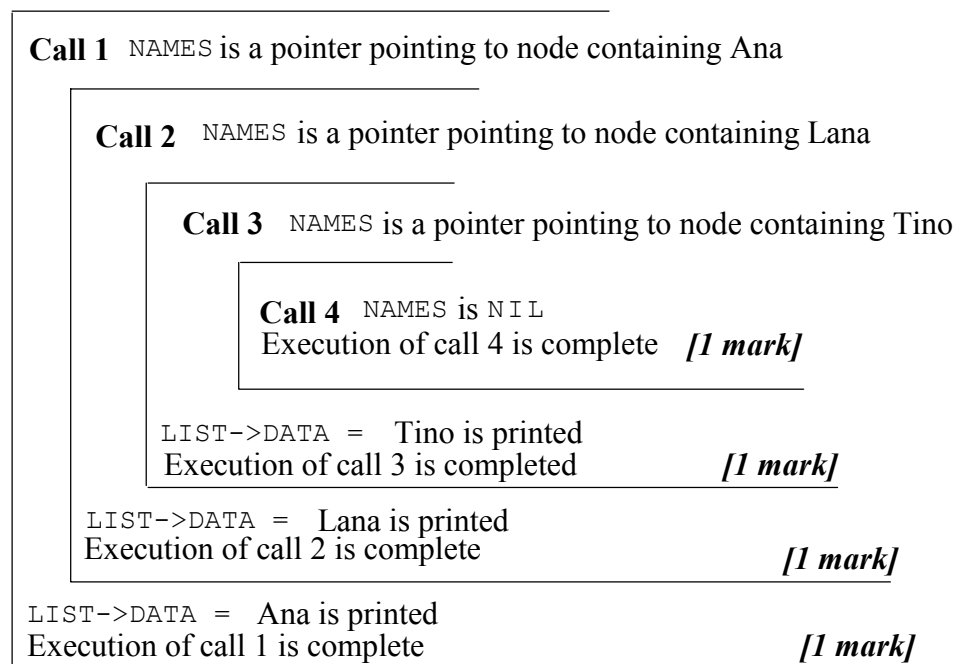
**[4 marks max]**



15. (a) (i) Base case: when `LIST = NIL`, (return to the statement following the last recursive call to `MYSTERY`); *[1 mark]*
- (ii) Recursive case: when `LIST <> NIL`, (recursive call passes the list pointed to by `LIST-> NEXT` (one node smaller list)); *[1 mark]*

*In each case accept the condition only.*

- (b) Answer can be given in a table, tree or any suitable form as long as the contents of the node are clear at each call.



Output: Tino, Lana, Ana *[1 mark]*

*[5 marks]*

- (c) To output the list;  
in reverse order; *[2 marks]*
- (d) Stack (of strings) or array; *[1 mark]*

16. (a) (i)  $B = \overline{\overline{X + Y} \cdot \overline{Y \cdot X + X + Y}};$

$$= (X + Y) \cdot (X + \overline{X \cdot Y} + Y);$$

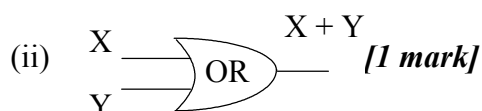
$$= (X + Y) \cdot (X + \overline{X} + \overline{Y} + Y);$$

$$= (X + Y) \cdot (1 + 1);$$

$$= X + Y$$

[4 marks]

Apply follow through as appropriate. If only  $X + Y$  is given award [4 marks].  
If a truth table is used allow [1 mark] for each correct column evaluating  $X, Y$  pair combinations to a maximum of [3 marks] and [1 mark] for the correct answer.



Pairs: (0,1) (1,0) (1,1) [2 marks]

[3 marks]

Follow through marks should be awarded.

(b) (i)  $-128;$

[1 mark]

(ii)

negative number

1	1	0	0	1	1	0	0
---	---	---	---	---	---	---	---

one's complement

0	0	1	1	0	0	1	1
---	---	---	---	---	---	---	---

+ one

0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---

number

0	0	1	1	0	1	0	0
---	---	---	---	---	---	---	---

$$110110_2 = 52_{10}$$

The number is  $-52_{10};$

[1 mark]

(iii) Any sensible answer, for example:

subtraction is a simple process;

[1 mark]