MARKSCHEME

May 2005

COMPUTER SCIENCE

Standard Level

Paper 1

14 pages

If you do not have a copy of the current Computer Science Guide, please request one from IBCA.

Subject Details:	**Computer Science SL Paper 1 Markscheme**

Mark Allocation

Section A: Candidates are required to answer ALL questions. Total 30 marks.
Section B: Candidates are required to answer any three questions (10 marks each). Total 30 marks.
Maximum total = 60 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. *Award [2 marks max] for any of following*:

    Convert sources code into object code / machine / executable
    Check for syntax errors
    Convert HLL to LLL   *[2 marks]*

    Do not accept answers such as 'to run a program'.

2. (a) If the value of P exceeds the dimension of the array;
         (there is an) attempt to access memory contents not in the array;   *[2 marks]*
         Do not accept references to non-integer values in P or X.

    (b) *Award [1 mark] for a statement of what is needed to be done.*

         Perform a check on the range of the value of P before calling the function

         Award [1 mark] for some explanation of how the range check is to be done.

         For example:

         if *(P<0 OR P>X.length)* **then**
                 output("error in index range")
         else
                 y = ABSOLUTE(P, X)
         endif

         N.B. *a written explanation would be acceptable.*   *[2 marks]*

3. *Award [1 mark] for an advantage*:
    Provides fast access;
    Allows access to a record without need to access other records;
    Enables online interactive processing;
    etc.

    Award [1 mark] for a disadvantage:
    Records can't be accessed in order;
    Requires more overhead from the computer system;
    More complex to implement than sequential access;
    May waste disk space;
    etc.   *[2 marks max]*

4. *Award [1 mark] for example and [1 mark] for at least two characteristics. No example, no mark.*

    (a)   online
           Petrol payment process via a credit card at the counter;
           The credit number is used to access the file directly;
           The account is debited straight away; *[2 marks]*

    (b)   real-time
           Petrol pump ongoing display of the price calculation;
           An embedded chip attached to a petrol volume sensor calculates the ongoing price without a human operator being involved;
           The calculations are performed in real-time and the result displayed, which constantly changes; *[2 marks]*

           Accept any reasonable example including those mentioned in the syllabus.

5. *Award [1 mark] if it is clear the meaning of the terms is known.*

Data verification is the process of checking that the data entered is equal to the actual data value used at input time *e.g.* when entering a new password it is usual for the user to be prompted to enter it twice as a check.
Do not accept "correct".
Data validation is the process of applying a reasonableness check *e.g.* a range check on an age value

Full marks can be awarded to students that provide correct definitions for both "validation" and "verification", without clearly stating the difference between them.

Award [1 mark] if the difference is explained.

The difference is that verification checks that the data matches the intended value, whereas validation applies a reasonableness check to a data value that may not actually match the intended value.
Verification checks accuracy and validation checks reasonableness not accuracy. *[2 marks]*

6. (a) *Award [1 mark] for correct answer, <u>some working required</u> i.e. calculate.*

16	8	4	2	1
1	1	1	1	1

Largest = 11111_2 = 16 + 8 +4 + 2 + 1 = 31_{10};

Or

Using the formula and n = 5 bits
2^n - 1 = 2^5 – 1 = 2*2*2*2*2 –1 = 32 –1 = 31;   *[1 mark max]*

Award no marks if no working shown.

(b) *Award [1 mark] for correct answer with some working.*

5 bits allows combinations from 00000 to 11111 = 2^5 = 32 different IDs.
Award no marks if no working shown.   *[1 mark]*

7. *Award [1 mark] for statement of function.*

Reduce the size of a file / by reducing the number of bits/bytes needed to represent the file.
Save storage space;

Award [1 mark] for description of use.

A large file that is to be sent via a network is compressed to reduce the size of the file to
reduce the time taken to transfer *i.e.* speed up transfer.   *[2 marks]*

Accept any reasonable description.

8. *Award [2 marks] for each definition.*

Syntax errors:
an error in applying the language
e.g. X + Y <--Z *[2 marks]*

Logical errors:
an error which gives the wrong result;
e.g. Do not accept array out of bounds or division by zero etc.   *[4 marks]*

Accept any sensible error which is not run time.
e.g. using X + Y instead of X * Y.   .

9.   *Award [2 marks] for each definition*:

Primary memory is used to temporarily store programs; (and data), it requires power otherwise content is lost; **RAM** and **CACHE** are typical examples; Data is fast to access and there is limited memory available;
ROM is primary memory which cannot be changed;

Secondary memory is used to permanently store data and programs; *e.g.* hard disks/CDs/ magnetic tape; typically much larger volume is stored and slower to access;   *[4 marks]*

10. Students are expected to give some detail and not just state key words.

(a)   *Allow [1 mark] for what the program should do and [1 mark] for why*.

For example:

Software has to reflect what the users require; or what the program is required to do; (within a larger system) and this should be determined before the design is made;
If this is not done the design will not reflect what is required; and is likely to need to be modified at great cost in time/money (in the future);   *[2 marks max]*

(b)   For example:

Testing is important to determine that the program functions; under a range of different circumstances (without crashing), *i.e.* is robust; Testing of the functions to determine that the requirements are met is also important; to ensure that the program performs the required processing as expected; Early testing is better than late testing;
          [2 marks max]

SECTION B

*Answer **three** questions.*

11.
  (a) "it is."

A	C	T	S	A[S]
it is.	**0**	**0**	**0**	**i**
		1		
			1	
				t
		2		
			2	
				space
	1			
			3	
				i
		3		
			4	
				s
		4		
			5	
				•
	1	4	5	

*Award **[1 mark]** for each correct column*   **[4 marks]**

  (b) *Award **[1 mark]** for correct answer no working required.*

   Return value = 2 *i.e.* 4 / (1+1)   **[1 mark]**

  (c) *Award max of **[2 marks]**.*

   The type signature declares the result to be real **[1 mark]**, and the returned value is the result of dividing two integers which could be real depending on how this is done **[1 mark]** or the result is an average and this should be declared as a real **[1 mark]**.
                                                                           [2 marks max]

  (d) Data is stored in memory and thus has a memory address; The data is given a variable name which is used to address the data in memory; When a variable is passed by reference the memory address is passed; not a copy of the data value as in pass by value. Hence operations on the data in the addressed memory location are reflected back in the calling part of the program;   **[3 marks]**

   Accept answers such as: "the parameter (not the value) is passed to the function; so if the (formal) parameter is changed/updated within the function; these changes will be kept in the original (actual) parameter; once the function is run.";

12.   (a)   By checking against the original mail order; after the quantity had been entered; *[2 marks]*.

Or

By prompting the clerk to enter the order quantity twice; and then comparing they are the same; or by prompting the clerk 'is this quantity correct Y/N'; after the initial entry had been made;   *[2 marks max]*

       (b)   The customer number would act as the primary key to the database so as to uniquely identify the customer *i.e.* there would be no duplicate IDs in case 2 names where the same; The ID could then be used to access the record directly on the disk or sequentially as required;   *[2 marks]*

       (c)   (i)   *Award [1 mark] for each of the following or equivalent points to a maximum of [4 marks]*.

A product ID searched for in the order table;
when a match is found; the customer ID in the order table;
could then be used to locate the customer name in the customer file;

[4 marks]

              (ii)   *Award marks as follows*:
Sequential in product file;
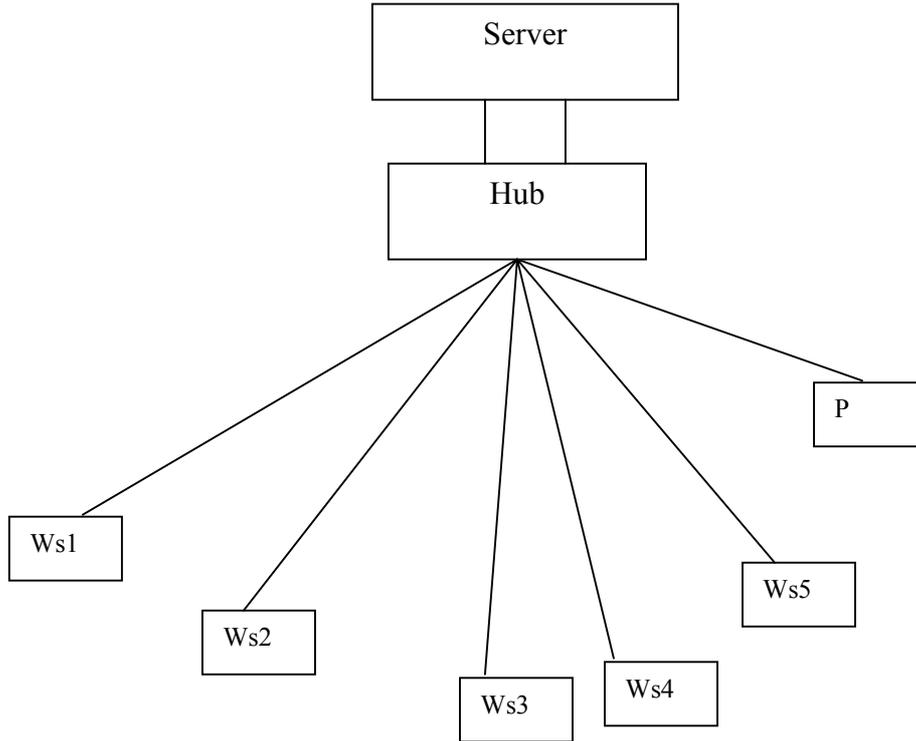Direct access to records in customer file;
Accept sequential in customer file if number of customers not too great in customer file;   *[2 marks max]*
Do not accept "batch processing".

13. (a)   *[2 marks]*

```
                        ┌─────────────────────┐
                        │       Server        │
                        └──────────┬──────────┘
                                   │
                        ┌──────────┴──────────┐
                        │        Hub          │
                        └─────────┬───────────┘
                                 ╱│╲ ╲ ╲
                                ╱ │ ╲ ╲  ╲
                               ╱  │  ╲ ╲   ╲
                                              ┌─────────┐
                                              │    P    │
                                              └─────────┘
          ┌─────────┐
          │   Ws1   │
          └─────────┘
                  ┌─────────┐
                  │   Ws2   │              ┌─────────┐
                  └─────────┘              │   Ws5   │
                                           └─────────┘
                          ┌─────────┐  ┌─────────┐
                          │   Ws3   │  │   Ws4   │
                          └─────────┘  └─────────┘
```

*Award **[1 mark]** for correct server hub configuration.*
*Award **[1 mark]** for correct work station and printer configuration.*   *[2 marks]*

(b)   Star topology;   *[1 mark]*

(c)   *Award **[2 marks]** for something equivalent to the following*:

The hub allows each device to have a (direct) connection to the server.   *[2 marks]*

(although the link to the server via the hub would be shared, however, this link is typically able to handle higher bandwidth.)

Hub allows each device (WS or Printer); to connect to the server;

Other answers giving full definitions of hub will gain [2 marks], e.g. "a switch that sends data to the devices; (Server, WS, Printer) to which it is attached";

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

Allows file sharing;
Allows shared access to a single printer;
Allows communication between users;
Allows access to larger private storage area on server;
Facilitates network backup;   *[2 marks max]*
Or any other relevant points.

(e)   Security is intended to prevent unauthorised access.
      Accept encryption.

      Award [1 mark] for any of the following or equivalent points:
      Accept "firewall", "virus protection software" and "encryption" if correctly outlined.

      The network operating system would provide secure login via user name and password;

      Which in turn would provide secure access to private disk space on the shared server
      disk space;

      The file management system would allow different access levels to be set per user *e.g.*
      read and write or read only;   *[1 mark max]*

(f)   (i)   *Award [1 mark] for the statement of any of the following devices*:
            A gateway/router/modem would need to be installed that facilitated connection to
            the external ISP and then routed data to and from this ISP.   *[1 mark]*

      (ii) *Award [1 mark] for a statement such as*:
            Detect data packets coming in and out of the network and send these to the
            appropriate input or output destination;
            convert analog-to-digital (only for modem);   *[1 mark]*

14. (a)   Browser; communications software; and email software;   *[2 marks max]*

   (b)   Batch processing; the distribution applications software would access a file of customer's email addresses and this would be done at a set time and the file processed all in one read through;   *[2 marks]*

   (c)   The computer system would need to be a multi-user environment; this means that the computer system would share its processing time amongst the current set of login users at any one time;
   Accept alternative systems which allow multiple login and which are feasible.
          [2 marks]

   (d)   *Award [2 marks] for any of the following outlines.*

   The customer data on the computer system would be backed up; and thus if the system failed the data could be restored; (provided the failure was not before the backup was taken)

   Data could be written to duplicate files; of the same computer / on different computers;

   Provided the data has been backed up or written to a duplicate file; a copy of the file can be accessed and restored to the users area;   *[2 marks max]*

   (e)   *Award [1 mark] up to a maximum of [2 marks] for any of the following or equivalent points.*

   Real time;
   A software module of the subscriber system on the server would need to be loaded to run automatically; (when a new subscriber was recorded)
   Real time; + software detecting automatically / software that would update counter as clients subscribe / something that suggests the user is not involved;
   The module would update the counter;
   The module would then refresh the window on the client *i.e.* owner computer; without the owner being involved; the refresh could be a popup window or a window that loads at start up etc;   *[2 marks]*