International Baccalaureate®
Baccalauréat International
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MARKSCHEME

November 2013

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 **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 that part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the
following points:

- Each statement worth one 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.

- If the candidate's answer has the same meaning or can be clearly interpreted as being the same as that in the markscheme then award the mark.

- Mark positively. Give candidates credit for what they have achieved and for what they have got correct, rather than penalizing 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. In this subject effective communication is more important than grammatical accuracy.

- 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   *Total: [40 marks]*

1.   *Award up to [2 marks max].*
     User manual;
     Installation instructions;
     (Online) help/support;
     Etc.   *[2 marks]*

2.   *Award up to [2 marks max].*
     To speed up access to data stored on the disk;
     It reorganizes blocks of data on a hard disk;
     Which became separated as data is added/deleted;
     To be next to each other;   *[2 marks]*

3.   (a)   It is correctly transmitted;
           Because the number of 1's is 4/an even number;   *[2 marks]*

     (b)   *Award [1 mark] for each comparison up to [3 marks max].*

Parity bit	Check sum
Calculated from the data at sending end	Calculated from the data at sending end
Calculated using only one byte	Calculated using several bytes
Parity must be either odd or even	Check sum could be any value
Transmitted together with the data	Transmitted together with the data
Recalculated at receiving end	Recalculated at receiving end
Etc. || *[3 marks]*

4.   *Award up to [2 marks max].*
     Text based;
     Base of any other software for creation of web pages;
     Cheap/free for schools;   *[2 marks]*

5.   (a)   *Award up to [2 marks max].*
           Hackers;
           Will attempt to gain access rights;

           OR

           Viruses;
           Could damage important data or hardware;
           Etc.   *[2 marks]*

     (b)   *Award [2 marks] for each implication discussed, ×2 up to [4 marks max].*

           Example:
           Lack of privacy;
           Students could be prevented from visiting unsuitable sites (games, chat rooms,
           etc.);
           Students could be prevented in copying/receiving/sending work from/to other
           students;   *[4 marks]*

6.   *Award up to [2 marks max].*
      Memory management;
      Resource handling;
      Program and data management;
      Coordinating processing;
      Communicating with peripherals;
      Etc.   *[2 marks]*

7.   (a)   A data structure in which elements are added/deleted only from one end (called the top
             of the stack);   *[1 mark]*

      (b)   *Award [1 mark] for each application up to [2 marks max].*
             Performing calculations / evaluating arithmetic and logic expressions;
             Translating from one to another computer language;
             Transfer of control from one to another method (store return addresses);   *[2 marks]*
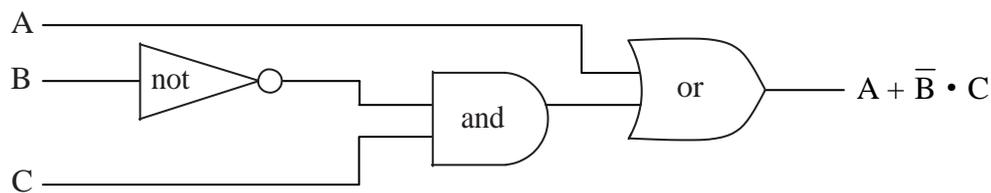

8.   (a)

A	B	C	$A + \overline{B} \cdot C$
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

             *Award [3 marks] if all rows are correct. Award [2 marks] if only 6 or 7 rows
             are correct. Award [1 mark] if only 4 or 5 rows are correct.*   *[3 marks]*

   (b)   *Award [1 mark] for each correct gate up to [2 marks max].*

                                                                                          [2 marks]

9. (a) (i) Register in ALU which holds all temporary results; *[1 mark]*

    (ii) Random access memory, holds programs that are currently executed, data and results; *[1 mark]*

  (b) (i) Interrupt allows current job to be temporarily suspended;
To perform another job with higher priority; *[2 marks]*

    (ii) *Award [1 mark max].*
Polling;
DMA; *[1 mark]*

10. $A5_{(16)} = 10100101_{(2)}$;
$5E_{(16)} = 1011110_{(2)}$;
$X_{(2)} = 10100101_{(2)} + 1011110_{(2)} = 100000011_{(2)}$; *[3 marks]*

11. *Award [1 mark] for each labelled flowchart symbol up to [5 marks max].*
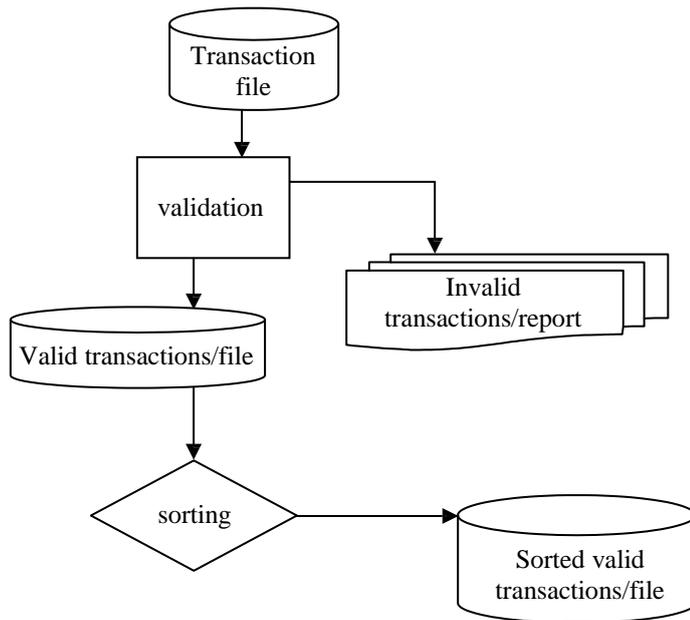
[5 marks]

SECTION B   *Total: [60 marks]*

12. (a) *Award [2 marks] for any benefit outlined up to [4 marks max].*
         The design can be precisely drawn/inputted by a pen;
         Held in a graphics file/stored within the memory;
         Using the pen, changes can be easily made;
         And the contents of the memory immediately updated;   *[4 marks]*

     (b) Designer's computer connected to the Internet (broadband, fibre optic or other);
         Secure link to company's server;   *[2 marks]*

     (c) When large graphic files are compressed they occupy less memory space on
         the designer's and company's computer;
         Transmission of smaller files is faster and cheaper;   *[2 marks]*

     (d) The data files should be encrypted/secured because they may be
         intercepted/read;
         And then misused by other designers or companies;   *[2 marks]*

                                                              Total: [10 marks]

13. (a) *Award up to [2 marks max].*
         Interview;
         Observation;
         Questionnaires;
         Studying literature;
         Etc.   *[2 marks]*

     (b) Two or more prototypes allow the system's owners/management to choose;
         Whichever is the best for the company / whichever they can afford;   *[2 marks]*

     (c) *Award up to [6 marks max].*
         New jobs in a town in an area where previously the main industry had been
         coal mining, but employees will need training, new skills requested for using
         the new system;
         The communication system in the area should be improved, in a major city it
         already exists;
         Some employees might be redundant, they could either lose a job or be sent to
         work in some other departments/to another town;
         Management and owners will also need training to use the system, some should
         move with their families to the new location;
         Job conditions and requirements are changed so managers will spend a lot of
         time in (re)organizing work;
         Owners may be happy because the increased efficiency and income;
         Or unhappy because of decreased efficiency/income;   *[6 marks]*

                                                              Total: [10 marks]

14. (a) Batch processing; *[1 mark]*

(b) (i) *Award up to [1 mark max].*
Wireless link;
Cable; *[1 mark]*

(ii) *Award up to [1 mark max].*
Broadband connection;
Satellite link; *[1 mark]*

(c) Analog form of temperature data measured by sensors;
Should be converted to digital form;
So it can be stored and processed by the computer; *[3 marks]*

(d) *Award [2 marks] for a strategy explained, ×2 up to [4 marks].*
All temperatures are stored in weather station;
And also on the central server;
So data can easily be recovered;
Two computer systems could be used;
The original and "mirrored" system;
So if one fails the other can be used; *[4 marks]*

Total: [10 marks]

15. (a) *Award up to [5 marks max].*
Begin at the root;
Move to a left;
Or a right subtree of a node;
Depending on whether the name is less than;
Or greater than the name in that node;
Eventually an empty subtree will be reached;
In which the new name is to be inserted;   *[5 marks]*

(b) *Award [1 mark] for showing that there are two links in each node, [1 mark] for the correct binary tree with the name Chris in the root up to [2 marks max].*

null	Chris	●

null	Colin	●

null	Lise	●

null	Richard	null
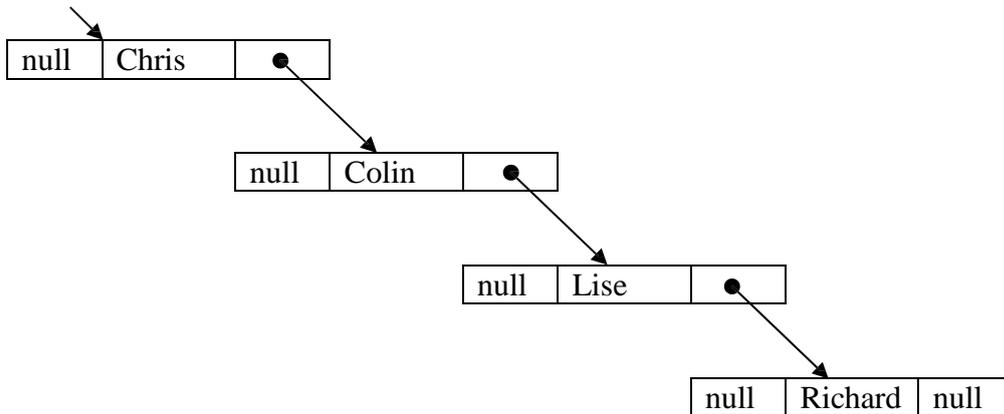
[2 marks]

(c) *Award up to [3 marks max].*
The efficiency of searching the binary tree in part (b) is O(n);
Same as efficiency of searching a linked list;
Because this binary tree is not well balanced;
Balanced binary tree has efficiency $O(\log_2 n)$;   *[3 marks]*

Total: [10 marks]

16. (a) *Award [1 mark] for the correct binary representation, [1 mark] for the decimal value up to [2 marks max].*
The binary representation of the least positive number is

0	0	0	0	0	0	0	1

and its value in decimal is 2^{-7} (=0. $0078125_{(10)}$) *[2 marks]*

(b) *Award [1 mark] for the correct binary representation, [1 mark] for the decimal value up to [2 marks max].*
The binary representation of the most negative number is

1	0	0	0	0	0	0	0

and its value in decimal is $-1_{(10)}$ *[2 marks]*

(c) (i) *Award [1 mark] for labelling the range of positive numbers, [1 mark] for labelling the range of negative numbers up to [2 marks max].* *[2 marks]*
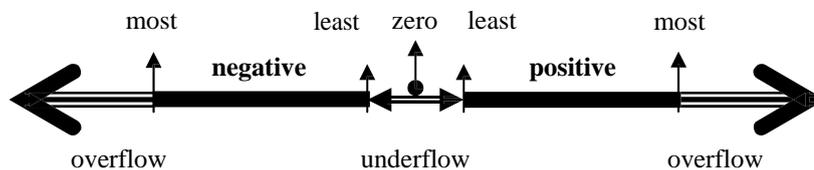
(ii) *Award [1 mark] for labelling the underflow area.* *[1 mark]*

(iii) *Award [1 mark] for labelling both overflow areas.* *[1 mark]*

Example sketch

(d) *Award [1 mark] for each comparison up to [2 marks max].*

	Fixed point representation	**Floating point representation**
Speed of calculation	Faster than floating point arithmetic	Slower than fixed point arithmetic
Programmer's time	More time needed to program	Less time needed
Range/accuracy	Better accuracy with decreased range	Wider range decreases accuracy

[2 marks]

Total: [10 marks]

17. (a) (i)   `k<0;`   *[1 mark]*

         (ii) `k>=0;`   *[1 mark]*

     (b) *Award up to [4 marks max].*
          Award [1 mark] for correct first pass through method;
          Award [1 mark] for correct second and third pass;
          Award [1 mark] for ending recursion correctly;
          Award [1 mark] for correct final answer;

           =X[5] * func(4, X);
          =X[5] * X[4] * func(3, X) =X[5] *X[4] * X[3] * func(2, X);
          (=X[5] *X[4] *X[3] * X[2] * func(1, X))
          (=X[5] *X[4] *X[3] *X[2] * X[1] * func(0, X))
          (=X[5] *X[4] *X[3] *X[2] *X[1] * X[0] * func(-1, X))
          =X[5] *X[4] *X[3] *X[2] *X[1] * X[0] * 1;
          =1 *1*2*4*10*3*1 =240;   *[4 marks]*

     (c) Calculates and returns product;
          Of the first k+1 elements in the array X;   *[2 marks]*

     (d) *Accept either description or code.*

          An iterative method could be used. Initialize a variable (product) to 1;
          Loop changing values of j from k down to 0. Multiply the variable(product)
          with the value X[j];

          OR

```
int func (int k, int [] X)
  { int p = 1;
    for (int j=k; j >= 0; j = j-1)
        { p = p * X[j];}
    return p;
  }
```
                                                                                              [2 marks]

                                                                                  Total: [10 marks]