Markscheme

May 2017

Computer science

Standard level

Paper 1

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The following are the annotations available to use when marking responses.

Annotation	Explanation	Associated shortcut
✔	Good Response/Good Point	(Alt+) 0
✘	Incorrect Point	(Alt+) 1
?	Unclear	
BOD	Benefit of the doubt	
NBOD	No benefit of doubt	
SEEN	Seen	
TV	Too vague	
REP	Repetition	
FT	Follow through	(Alt+) 2
L	(Comp Sci) Language	(Alt+) 3
D	Description	(Alt+) 4
A+	Analysis	(Alt+) 5
REF	Reference	(Alt+) 6
DEV	Development	(Alt+) 7
B+	Balanced argument	
OC	Off course	(Alt+) 8
EVAL	Evaluation	
O	Opinion	
▭	Dynamic, horizontal line that can be expanded	(Alt+) 9
∿	Dynamic, horizontal wavy line that can be expanded	
∿	Dynamic, vertical wavy line that can be expanded	
T	Text box	

You **must** make sure you have looked at all pages. Please put the SEEN annotation on any blank page, to indicate that you have seen it.

General marking instructions

1.   Follow the markscheme provided, award only whole marks and mark only in **RED**.

2.   Make sure that the question you are about to mark is highlighted in the mark panel on the right-hand side of the screen.

3.   Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**

4.   Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases use RM™ Assessor annotations to support your decision. You are encouraged to write comments where it helps clarity, especially for re-marking purposes. Use a text box for these additional comments. It should be remembered that the script may be returned to the candidate.

5.   Personal codes/notations are unacceptable.

6.   Where an answer to a part question is worth no marks but the candidate has attempted the part question, enter a zero in the mark panel on the right-hand side of the screen. Where an answer to a part question is worth no marks because the candidate has not attempted the part question, enter an "NR" in the mark panel on the right-hand side of the screen.

7.   Ensure that you have viewed **every** page including any additional sheets. Please ensure that you stamp "SEEN" on any page that contains no other annotation.

8.   A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect using a text box or the "CON" stamp.

Subject details: **Computer science SL paper 1 markscheme**

Mark allocation

Section A: Candidates are required to answer **all** questions. Total 25 marks.
Section B: Candidates are required to answer **all** questions. Total 45 marks.
              Maximum total = 70 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**".

General guidance

Issue	Guidance
Answering more than the quantity of responses prescribed in the questions	• In the case of an "identify" question, read all answers and mark positively up to the maximum marks. Disregard incorrect answers. • In the case of a "describe" question, which asks for a certain number of facts *eg* "describe two kinds", mark the first two correct answers. This could include two descriptions, one description and one identification, or two identifications. • In the case of an "explain" question, which asks for a specified number of explanations *eg* "explain two reasons …", mark the first two correct answers. This could include two full explanations, one explanation, one partial explanation *etc*.

Section A

1.   It is when an application/program is tested/ to get feedback (for errors/improvements);
By releasing it to the general public/users/stakeholders before final release;   **[2]**

2.   *Award up to [2 max].*
Natural disaster/power failure;
Accidental deletion;
Malicious activities (hacking/theft/viruses);
Hardware/software/system failure;
Bad integration/migration of systems/data;
Transmission error;
Lossy compression when the original no longer available only the modified version;   **[2]**

3.   *Award up to [2 max].*
To patch any vulnerabilities/bugs/cyberspace threats;
To provide improved functionality/new functions/usability/maximize efficiencies;
To generate income for the software company/to innovate and stay ahead of other software companies;
To ensure compatibility with other (updated) technologies;   **[2]**

4.   Cache memory can be accessed/is faster than RAM;
It is used to hold common/expected/frequently used data/operations;
Closer to CPU than RAM/situated between RAM and CPU/on same board as CPU/ with faster read/write speed;
Cache memory is static RAM and this memory doesn't need to be constantly refreshed;   **[2]**

5.   The OS allocates (and deallocates) specific sections of memory to each program/process/module;
This ensures that the memory assigned to one program is not overwritten;
Uses secondary/virtual memory to allow more processes to run simultaneously;
(**Note:** *Do not accept vague reasons*).   **[2]**

6.   *Award up to [2 max] for any two of the following:*
Physical layer;
Data link layer;
Network layer;
Transport layer;
Session layer;
Presentation layer;
Application layer;   **[2]**

7.   Some compression methods (lossy) discard data;
Decompression will not return the complete file/some detail will have been removed;
Which in some cases e.g. audio/video may be unacceptable;
If original not saved/lost there is no way to recover it;   **[3]**

8.   *Award up to [3 max].*
The MAC address identifies a specific device (network card/controller);
MAC address checked against list of approved addresses/whitelist If not on list access to network is denied;
Prevents unauthorized access/makes access more difficult/(unless the NIC is cloned)/providing an extra layer to authentication process;
data sent to a specific MAC address can only be accessed on that device;   **[3]**

9.   The list is searched for the next element in order;
And placed in its correct position in the new list deleting original **OR** in the same list by swapping with the element that was there;
This is repeated for all elements;   **[3]**

Note: The sorted list may be constructed by swapping positions in the origin list or by putting in the element in the correct position in a separate list and deleting from the unsorted list.

10. *Award [1] for identifying a way in which a higher-level language may differ from another and [1] for developing that difference, up to [2 max].*

Mark as 2 and 2

Method of translation;
Whether by compiler or interpreter (or both);

Loosely/strongly typed;
Refers to whether data types are specified;

Different programming paradigms;
Procedural or object oriented etc.;

Purpose of the language;
Specific (*eg* scientific/AI) or general;

Compatibility with different environments;
Java with virtual machine can run on all O/S / some languages are O/S specific;

Syntax differences;
Structure of statements *etc*;   **[4]**

Note: Accept other reasonable answers.

Section B

11. (a) (i) Data migration is the transfer of data from one system/storage device to another;
(Importing the data/database from the company to the company system) **[1]**

(ii) *Award* **[1]** *for identifying a problem that may arise and* **[1]** *for an expansion /
elaboration up to* **[2 max].**

Mark as 2 and 2

Data loss;
Due to transmission faults/lack of adequate storage;

Incompatible file formats;
Which could lead to incomplete or incorrect data transfer;

Different file structures;
Which will result in a mismatch of data, for example in customer records;

Validation rules differ between companies;
Which could lead to inconsistent/incorrect results;

Different character sets might be used;
Which could lead to inconsistent/incorrect results;

Different languages might be used;
Leading to translation issues;

Data corrupted when transferring (data) files;
And not usable at destination; **[4]**

Note: *Accept data loss as an issue unless the expansion is a repeat of the second
issue identified.*

(b)   *Award **[1]** for identifying each aspect of change management that may arise and **[1]** for an expansion / elaboration up to **[2 max]**.*

Mark as 2 and 2

Workforce issues;
Such as redundancy/retraining;

The time frame involved;
In merging the two systems;

Testing;
Of the combined systems/new data;

Data entry;
If migration not possible;

Costs involved;
In the aligning of the two systems;

Changeover decisions;
Such as parallel running *etc*;   **[4]**

(c)   (i)   *Award up to **[3 max]**.*
              If intermediate columns are not used:
              *If A, B and C are all correct, award **[3]** marks*
              *If A, B and three outputs from C are correct, award **[2]** marks*
              *If A and B are correct, award **[1]** mark*

              If intermediate columns are used:
              If C is not correct and intermediate columns are used:
              Award [1] mark for Columns A and B being correct
              Award [1] mark for either X or Y or both being correct
              If A, B and C are all correct, award 3 marks

A	B	NOT(A AND B)	A OR B	C=NOT(A AND B) AND (A OR B)
0	0	1	0	0
0	1	1	1	1
1	0	1	1	1
1	1	0	1	0

[3]

       (ii)   XOR gate;

               Note: *Follow through from an incorrect truth table in part (c)(i).*
               Accept A XOR B = C   **[1]**

(d)   Two truth tables can be compared;
       The same outputs from the same inputs, the circuits are equivalent;   **[2]**

12. (a) *Award [1] mark if evident from the trace table that the loop executes exactly 4 times*
[1] mark for correct contents of B (2 and 4)
[1] mark for the correct contents of C

DATA.hasNext() ?	A	A >= 0 ?	A mod 2 = 0?	Contents of B	Contents of C
true	2	true	true	2	
true	4	true	true	2, 4	
true	-1	false	*true	*2, 4	
true	3	true	false	*2, 4	3
false					

Note: * These cells could be left empty

[3]

(b) *Award [4] marks as follows:*

A position/index of the middle value calculated from HI and LOW;
If search value equals to value in the array at this position, then end;
Otherwise, change HI or LOW according to whether search value is above or below;
Repeat the process until search value is found;

Example answer 1:
1. Calculate MID (the midpoint of LOW and HI)
2. If ARRAY[MID] is the search value, end, else
3. If search value < than ARRAY[MID], HI = MID-1, else LOW = MID+1
4. Repeat steps 1, 2 and 3 until found

Example answer 2:
Find/calculate the midpoint/median value between HI and LOW;
If the array value at midpoint equals the search value; then the search value
is found;
If search value is greater than the array value at midpoint, set the midpoint as a new LOW
and repeat the process - if search value is less than the array value at midpoint, set midpoint
as a new HI;
Repeat until search value is found;

[4]

(c)   *Award up to [5 max] as follows.*

Example answer 1:

[1] mark for a loop through collection NUMBERS
[1] mark for the assignment into the array from the collection// do not accept NUMBERS as array
[2] marks for a correct linear search, *1 mark* for the loop and 1 mark for the comparison and use of flag
[1] mark for correct input of search value and output message

```
input S // search item
COUNT = 0
loop while NUMBERS.hasNext()        // or … while NOT
                                    //NUMBERS.isEmpty()
  D[COUNT] = NUMBERS.getNext()
  COUNT = COUNT + 1
end loop
FOUND = false
X = 0
loop while (X<COUNT) and (FOUND == false) //accept for loop
  if S == D[X]
    FOUND = true
    X = X + 1
  end if
end loop
if FOUND == true
  output "found"
else
  output "not found"
end if                                                                   [5]
```

Example answer 2:

(in this example assignment into array done in same loop as reading from NUMBERS)

[1] mark for a loop through collection NUMBERS
[1] mark for the assignment into the array from the collection //do not accept NUMBERS as array
(**Note:** Do <u>not</u> award this mark if flag is used to terminate/break the while loop)
[2] marks for correct linear search (through D), **[1]** mark for correct comparison, **[1]** mark for flag
[1] mark for correct input of S and output message

```
input S // search item

COUNT = 0
FOUND = false
loop while NUMBERS.hasNext()      // or … while not NUMBERS.isEmpty()
  D[COUNT] = NUMBERS.getNext()
  if   S == D[COUNT]
    FOUND = true
  end if
  COUNT = COUNT + 1
end loop
if FOUND
  output "found"
else
  output "not found"
end if                                                                    [5]
```

(d)   *Award up to **[3 max]**.*
       ***[1]** mark for setting and changing a flag*
       ***[1]** mark for starting from the 2nd entry and checking all values as being entered*
       ***[1]** mark for comparing the current value with the previous one*   **[3]**

       Note: *Do not accept pseudocode/code.*

13. (a) (i) WAN/GAN (global area network)
VPN;
Do not accept LAN or MAN or VLAN   **[2]**

(ii) *Award [3 max] for one of the networks:*

(WAN/GAN)
A secure authentication process;
That involves login, passwords and security questions *(response should include at least two of these)*;
One-time pads;
Encryption;

(VPN)
Authentication;
Tunnelling;
Which is a packet within a packet;
(Each layer) encrypted;
Location and IP of user masked;

Give follow through for wrong answer in (i) including answers of wireless/cabled   **[3]**

(b) *Award marks as follows:*
[2] marks for a clear understanding of protocols and packet switching
[2] marks for explaining the importance of protocols in construction of packets/standard packet format with examples of information included in each packet
[2] marks for a discussion of the role of protocols in the routing of packets to their destination

For example:
Packet switching involves splitting data into packets to transmit to a specific destination;
Protocols are rules/standards used to compile and transmit each packet in a standard format;

Essential that all packets are constructed exactly the same;
So that the receiver knows automatically how to decode the contents/does not need further instructions for decoding the packets;
Error checking methods included to verify that data arrives in same state as it was sent;

Protocols include destination information that means that at each node the packet passes through it is sent to the next node towards the correct destination;
Packet number essential to be included for reassembling at the other end as not all packets will arrive in order;   **[6]**

Note: *Construction and transmission will not necessarily be separated but it should be clear that protocols are used to construct packets for successful transmission. Accept valid alternatives.*

(c) *Award [1] for identifying a use of WIFI in public places and [1] for expanding the advantage, up to [2 max].*

Mark 2 and 2

Social:
Keeping up to date when away from home/abroad/travelling/in hospital;
Can gain access to information such as email/social sites/sports results/ facetime family and friends from long distance/get your homework to do in cafe;

Business:
Working away from home (if you work from home);
Avoids missing important meetings if not present or travelling and not able to attend a meeting/ makes possible to work on documents;

Immediate information:
Access to public facilities;
Make immediate payments/check local transport timetables/taxi (uber)/book restaurants;

Cost saving:
Convenience of mobile accessibility;
Without the cost incurring using a mobile network such as 3G/4G;   **[4]**

Note: Answers to not have to come from these categories but they should be used as a guide to avoid giving credit to repetitions.