Markscheme

May 2022

Computer science

Standard level

Paper 1

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.   *Award [2 max].*
      Language differences / lexical differences present across datasets to be merged;
      Data representation differences / different data structures (e.g., date format, incompatible file formats);
      Incompatible hardware;
      Incompatible operating systems / different software versions;

                                                                                                        [2]

2.   *Award [2 max]*
      User efficiency;
      To ensure that users know how to use the system correctly;

       Support/Troubleshoot;
       To provide users help when they encounter errors;

      Accuracy;
      To ensure the correct methods are used to enable reliable output;

      Improved user experience;
      the user is aware of all available features, so they can make the most out of the system;
                                                                                                        [2]

3.   *Award [2 max]*
      WAN covers a much larger area (national/international), LANs usually cover a smaller area (such as a single site);
      Nodes connected to WANs often make use of connections through public networks (such as the telephone system), nodes connected to LANs are usually connected through private infrastructure;
      LANs are more secure than WANs (due to how WANs transmit the data /how far the data would need to travel);
      A higher bandwidth is available for transmission in a LAN than a WAN/ LANs can have a higher data transfer rate than a WAN;
      LAN is typically cheaper than WAN to implement/ maintain (as the equipment required for LAN is less expensive);
      WAN includes a large number of devices connected together, LAN includes less;
      WANs are typically slower than LANs due to the distance data must travel;
      WAN requires hardware to connect different networks, such as a router, LAN can be simple and does not need to connect to other networks;

                                                                                                        [2]

4. *Award [2 max]*
The reason for compression when transmitting data is to save on transfer times;
As it reduces the number of bits needed to represent data (when compared with the original data);

Compressing data involves modifying/restructuring files, so that they take up less space;
And this results in cost savings in cloud storage;

To take up less bandwidth;
Because data compression reduces the size of files to be transmitted over a network;

Note to examiners: Award [1] for a reason (for example, to save data usage for sending files over the internet, to save storage capacity, to speed up file transfer, to decrease costs for network bandwidth, etc.), and award [1] for an expansion.

[2]

5. *Award [2 max]*
(The program written in HLL must be translated into machine code) so that the computer can <u>execute</u> the program;
as the computer only understands machine language / as code written in HLL can only be understood by humans and cannot be interpreted by the computers (which work in binary);

[2]

6. *Award up to [4 max]*
1 mark for every two correct rows;

A	B	C	P	Q	X
0	0	0	0	1	1
0	0	1	0	0	1
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	1	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	0	0	1

[4]

7. (a) *Award [2 max]*
Award [1] for showing workings.

(0)1101001;

[2]

(b) *Award [2 max]*
Award [1] for showing workings.

C8;

[2]

8.   *Award [1 max]*
memory management;
Note to examiners: allow any other correct function of a single-user operating system.

[1]

9.   *Award [1 max]*
The extent to which a device can be used by specific/its users;
To achieve specific goals effectively/efficiently/satisfactorily;

[1]

10.   *Award [2 max]*
Standards ensure compatibility between nodes on the network;
Through the use of common techniques/protocols/language;

[2]

11.   *Award [3 max]*
Cache is high-speed memory;
Located between CPU and RAM;
Frequently used data/instructions are (temporarily) stored in cache memory;
To reduce the access time needed/Speed up retrieval time/To improve the speed of processing;
CPU searches as instruction's address first in the cache, and if not found, in RAM;

[3]

Section B

12. (a) (i) *Award [1 max]*
End users/ employees/ customers/ community members/ media/ suppliers;
Business owners/ managers/ shareholders/ investors;

[1]

(ii) *Award [2 max]*
User dissatisfaction;
because the system does not meet user requirements;

Developers not being paid for the final product;
as the business owner requests are not evident in the final product/ or outside of the project's scope;

Unsuccessful final product;
the developed system may either solve a different problem/ is not user friendly as compared to the existing system;

Note to examiners: Reward other reasonable responses.

[2]

(b) *Award [4 max]*
Examining current systems (using interviews/ surveys/direct observation);
To compare the existing system against possible requirements to identify missing features;

Examining competing products;
To compare own system with competitors to enable decisions on features to add;

Review of organizational capabilities;
To determine how well the organization manages resources to gain an advantage over competitors;

Literature searches;
To research current methods and to help inform development choices;

Mark as 2 and 2

[4]

(c) *Award [2 max]*
Testing is important (at every stage) to make sure the system operates in line with user requirements/as intended;
To prevent the end user being dissatisfied with the final system;

Testing is important to enable early discovery of errors;
to reduce time delay/ using more resources / avoid higher cost;

[2]

(d)   *Award [6 max]*
        Award [1] for method, award [1] for benefit and award [1] for drawback.

        Parallel running;
        The old and new systems run together, so if a problem is found with the <u>new</u> system, it can be repaired/the old system can take over;
        This is expensive as duplicate systems and staff are needed;

        Pilot running;
        The new system is only implemented in one branch of the organization so disruption is kept to a minimum;
        It can take a long time for the new system to be fully implemented / two systems are still in operation within the organization, leading to duplication and possible errors;

        Direct changeover;
        The new system is implemented overnight so the changes happen very quickly;
        If the new system fails, the company has no working system to fall back on;

        Phased conversion;
        Only one area/department/part of the system is updated at a time, so the disruption is kept to a minimum;
        Multiple systems which may not be compatible with each other will be running at the same time;

        Note to examiners: Accept other suitable examples of benefits and drawbacks.

        Mark as 3 and 3.

                                                                                        [6]

13. (a) *Award **[2 max]***
```
if;
then;
else;
```

Note to examiners: allow an alternative descriptive version such as:
test/condition;
action/consequence;
(optional) alternative action/consequence;

[2]

(b) *Award [5 max]*
Award [1] for an appropriate loop with correct loop parameters to cover 30 array elements/all students
Award [1] for correct use of indexes in two arrays (MARK *and* GRADE)
Award [1] for each if statement with correct condition and grade assignment up to [4].

Note to examiners: *Award [4] if candidate has correctly used an alternative conditional statement such as switch/ case.*

Example answer 1:

```
loop COUNTER from 0 to 29
    if MARK[COUNTER] >= 80
      then GRADE[COUNTER] = "Distinction"
      else
        if MARK[COUNTER]>˝= 60
          then GRADE[COUNTER] = "Merit"
          else
            if MARK[COUNTER} >= 40
               then GRADE[COUNTER] = "Pass"
               else
                    GRADE[COUNTER] = "Fail"
            end if
        end if
    end if
end loop
```

Example answer 2:

```
COUNTER = 1
loop while COUNTER <= 30
    if MARK[COUNTER-1] >= 80
      then GRADE[COUNTER-1] = "Distinction"
    end if
    if MARK[COUNTER-1] >= 60 and MARK[COUNTER-1] < 80
         then GRADE[COUNTER-1] = "Merit"
    end if
    if MARK[COUNTER-1} >= 40 and MARK[COUNTER-1] < 60
          then GRADE[COUNTER-1] = "Pass"
    end if
    if MARK[COUNTER-1} < 40
             GRADE[COUNTER-1] = "Fail"
    end if
    COUNTER = COUNTER + 1
end loop
```

[5]

(c) *Award [2 max]*
Three arrays are parallel/ they have the same number of elements/ the same length;
the same array index can be used to represent name, grade and mark of the same student/
the array index makes sure that data from the three arrays lines up;

[2]

(d) *Award **[3 max]***
*Award **[1]** for correct loop to check all students*
*Award **[1]** for correct conditional statement checking correct array*
*Award **[1]** for correct output*

Example answer 1:

```
loop COUNTER from 0 to 29
    if MARK[COUNTER] >= 60 then
      output NAME[COUNTER], GRADE[COUNTER]
    end if
end loop
```

Example answer 2:

```
loop C from 0 to 29
  if GRADE[C].equals("Merit")OR GRADE[C].equals("Distinction")
      then
          output NAME[C], GRADE[C]
    end if
end loop
```

[3]

(e) *Award **[3 max]***
*Award **[1]** for an input statement before the loop;*
*Award **[1]** for changing the conditional statement so that it checks the* GRADE[] *array for the* GRADE *input (using the same variable)*
*Award **[1]** for outputting the name and marks of the student who has achieved the inputted grade*

Note to examiners: Accept a written explanation or an amended algorithm that corresponds to candidate's answer to part(d).

Example 1:

```
G=input()
COUNTER = 0
loop while COUNTER < 30
    if GRADE[COUNTER] = G
      then
          output(NAME[COUNTER], MARK[COUNTER])
    end if
    COUNTER = COUNTER + 1
end loop
```

[3]

14. (a) *Award [4 max]*
Award [1] for TO_FIND *and* LOC *columns;*
Award [1] for ITERATE *column;*
Award [1] for DATA_ARR[ITERATE] *column;*
Award [1] for the correct output;

TO_FIND	LOC	ITERATE	DATA_ARR [ITERATE]	Output
39	FALSE	0	27	
39	FALSE	1	29	
39	FALSE	2	36	
39	TRUE	3	39	
				39 is in the array

[4]

(b) *Award [1 max]*
LIMIT

[1]

(c) *Award [4 max]*
Award [1] for LOW_LIM *column;*
Award [1] for UP_LIM *column;*
Award [1] for MID_VAL *and* DATA_ARR[MID_VAL] *columns;*
Award [1] for TO_FIND, LOC *and Output columns;*

TO_FIND	LOC	LOW_LIM	UP_LIM	MID_VAL	DATA_ARR [MID_VAL]	Output
50	*FALSE*	0	11	5	42	
50	FALSE	6	11	8	58	
50	FALSE	6	7	6	45	
50	TRUE	7	7	7	50	
						50 is in the array

[4]

(d) *Award [1 max]*
The value (of MID_VAL) changes during the operation of the algorithm;

[1]

(e)   *Award [5 max]*

Award [3 max] for sequential search
The algorithm searches through every element in the array starting at the beginning and working through one after the other;
…until the required item is found;
This method is potentially slow if the data set is large and the required element is towards the end of the list;
The data does not need to be in any particular order;

Award [3 max] for binary search
The data must be sorted before it is stored;
After comparing the data set with the target data, half of the data can be discounted using a simple condition;
…enabling the target to be more quickly located;

Note to examiners: Big O notation is not on the syllabus so answers with reference to this are not expected, however, if this type of answer is seen, please allow, for example:

Sequential: main disadvantage is O(N) so inefficient;
advantage is that it works with an unsorted array;
Binary search: main advantage is that it's efficient as it's O(log n);
disadvantage is that the array must be sorted (and so must be sortable – not all data has a defined sort order);
Binary search cannot be performed on a linked list but a sequential search can;

[5]