8823 – 6907M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2024

Computer science

Standard level

Paper 1

12 pages

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]***

Neatly organized information (rows and columns, tables, dropdown lists, worksheets)
Automatic calculation based on the formulas/functions (custom or pre-set);
Data filtering;
Data visualization (bar charts/pie charts/graphs/ variety of styles and colours);
Cell/table formatting (custom or pre-set) (sizes, colours, cell background, insert headers, merge cells, etc.);
Conditional formatting;
Automated tasks (auto-fill cells, update cell values, automated formatting);
Text manipulation;
Sorting;
Pivot tables;
Data validation;
Comments/ notes (for collaboration and clarification);
Sharing and co-authoring (multiple users can work on one document simultaneously);
Data import/ export (easily import data from various sources (e.g., databases), save spreadsheets in different formats (e.g., PDF);
Security features (password protection, file encryption);
Accessibility features (screen reader, assistive technologies for visually impaired users, keyboard shortcuts);
***Note**: Reward other correct responses.*

2. *Award **[2 max]***

helps to reduce the risk of program/ product failure;
by getting direct feedback from real / end users (each end user performs testing in the end-user's location);

beta testing allows the testing of the product over a range of devices/networks/ operating systems;
allowing the developers to test functionality over a range of environments and configurations;

show how the program works in real-world environment / test by real users;
help to detect any issues/bugs (which are overlooked/undetected by the development team /during internal testing);

beta testing engages end users (and creates excitement);
which helps building a loyal user/customer base;

***Note**: Reward other reasonable responses.*

3. *Award **[2 max]***

the users identify key issues (positive and negative) in the current computer system;
describe what they think is wrong with the current computer system;
explain how they use the current system;
explain how they think the current system can be improved;
the users can test and provide feedback on the new system;

***Note**: Reward other correct responses.*

4. *Award **[4 max]***
*Award up to **[2 max]** for strengths and up to **[2 max]** for weaknesses/limitations.*

Strengths:
Possibility of detecting/recovering from errors without a lot of down time/ it is easy to roll back if something is not functioning correctly;
Issues with one phase only affect a small area of the organization;
The conversion is done gradually so more time is available for adjustments/ time for the users to adapt is longer;
Users gain early process and software knowledge that they can use in the subsequent phases;
Technical staff can concentrate on part of the system or some of the users/the burden on the technical staff is minimal in this method;

Weaknesses/limitations:
Project duration for full implementation is long/system deadline is unclear;
The implementation may appear unclear to the users;
Training sessions are confusing for users as they are asked to work with the new and the old system;
A 'fall back' to the old system is becoming more difficult with every new phase;
It can prove costly because of adjustments that are needed (for example, temporary interfaces)/ correctness and completeness of the data has to be checked several times;

5. *Award **[2 max]***

a physical address/ hardware identification number/ 12-digit hexadecimal number assigned by the manufacturer to a network interface in a device;
that helps to uniquely identify each device on a network;

6. *Award **[2 max]***

to graphically/diagrammatically present a system;
describing the devices/files/media used and tasks/events to be performed by the system;
so, to help better understand the system/ identify bottlenecks/ inefficiencies/ redundancies/ suggest improvements/ optimizations;

to represent all the components in a system (inputs and outputs, storage, processes, and decisions);
using standard symbols (shapes, arrows);
that provide visual clarity/ help to understand/ analyse the flow of the process;

7. *Award **[3 max]***

A firewall (a device or software protecting sensitive resources in a network)
controls incoming and outgoing network traffic according to predetermined security rules;
monitors data packets entering and leaving the guarded network, allowing or blocking them;
controls which applications/devices can access the network;
detects/ prevents other threats, such as viruses, malware, suspicious behaviour, different types of Internet attacks;

8. *Award **[2 max]***

low power consumption prolongs battery life/No need to charge the device as often;
less energy consumption - cheaper energy bills;
increased mobility/portability of devices;
Device is less likely to overheat;

9. *Award **[4 max]***

*Award **[1]** for each correct column.*
The trace table may be differently presented.

A	B	TEMP	output
20	12	12	
12	8	8	
8	4	4	
4	0		4

10. *Award **[2 max]***

Collection holds objects/data that can be of different types/ has different ways of organizing data /objects it contains;
Collection can hold an unlimited number of values (limited only by the amount of available memory);
Collection has a set of in-built methods (getNext etc) that define operations performed on the elements/objects;
Reduced programming effort (implementations of data structures are provided in collections);
Increased performance of the program (efficient pre-defined algorithms);

Section B

11. (a) *Award **[1 max]***

A password should be assigned to the device (biometric passwords could be used);
Should not store sensitive data on the laptop;
Safeguard all passwords / should not store username/password account logins (or "remember me" cookies) on the device;
Encrypt the SSD / hard drive;

***Note:** Reward other correct responses.*

***Note:** Backing-up will not keep the data secure, it will only allow recovery of data removed, so no marks for the answer: 'Regularly back up the SSD / hard drive to another location'.*

(b) *Award **[2 max]***
*Award **[1]** for identifying an OS feature and award **[1]** for a reasonable expansion.*

Security management;
confidential data stored in the system is protected by the operating system/ the system is protected from malware attack;

GUI / I/O operations;
OS can handle I/O operations to hide the behaviour of hardware from the user;

Process management;
The program execution is managed effectively by the operating system without any overlapping or time delay/ The OS to develop and provides mechanism for communication and synchronization within multiple processes;

Storage/ Memory management;
OS performs memory management and virtual memory multitasking/ The need for memory management in OS is to allocate and de-allocate memory space to process/ The OS can do resource allocation and prevent the system from overloading /to ensure it meets the minimum requirements of the application;

Disk management;
OS permits disk access to manage files systems, file system device drivers and related activities of files like retrieval, naming, sharing, storage, protection of files;

Loading and execution;
The command interpretation is made to interpret the given commands and make the resources to act on the system by processing the commands;

***Note**: Reward other correct answers.*

(c) *Award **[4 max]***

(*the laptop manufacturer includes both wired and wireless network connection capability*)
to deliver customer (laptop user/owner) satisfaction/ customer loyalty/ improve overall customer experience/ meet customer expectations;
laptop users (customers) can decide which connection is best (for them) in a particular situation;
users can move around freely / able to work in a setting outside the home/ office (and still stay connected from any location within the wireless network's coverage area or from any WIFI hotspot);
for tasks that require large amounts of data to be transferred users are able to use a wired network rather than wireless as the bandwidth is much larger/ faster transmission;
where wireless connection is weak/ unavailable users can count on an Ethernet cable adapter/ use wired network to get the connection they need;
wireless networks can be easily hacked, so wired connection can be used when working / transferring sensitive data/ it is more difficult for unauthorised users to intercept data in a wired network;

***Note**: Reward other reasonable benefits to their customers (laptop users), (knowing the advantages/ disadvantages of wired/ wireless connections) such as convenience, increased mobility, security, cost.*

(d) *Award **[2 max]***

The data packet structure includes the header, payload (and trailer);
It contains information about the data carried by the data packet such as its origin and destination IP addresses, number of packets, etc.;
the actual data (payload) that the packet is delivering to the destination;
and control signals/ additional information about the packet (such as data that tell the receiving device that it has reached the end of the packet);

(e) *Award **[6 max]***
*Award **[1]** for a reason, award **[1]** for an extension, **x3**.*

(Network protocols are necessary because protocols do)

provide the rules for effectively managing/ operating a computer network;
allowing network administrators to monitor network performance/ detect bottlenecks /identify and troubleshoot network issues/ configure network devices remotely / for example, network management protocols such as ICMP and SNMP;

define the policies/ procedures to determine how data is transmitted between different devices in the network;
for example, network communication protocols such as TCP/IP and HTTP;

provide security services (for example, encryption, authentication) for data transmitted over the network;
for example, network security protocols such as IPSec, HTTPS, SFTP, and SSL;

include mechanisms/functions for flow control;
mechanisms for devices to identify and make connections/ formatting rules that specify how data is packaged into messages sent and received / the amount of transferred data between the communicating computers must be agreed in such a way that the data can always be stored on the target computer;

include error checking functions (in a communication protocol);
that help to detect errors/ eliminate distortions (for example, distortions that can be caused by the poor quality of the transmission, etc.);

include mechanisms for congestion control /include precautions that serve not to overload a network;
because when overloading a network, the transmitted data blocks often have to be discarded/ the transmission time of data blocks in the network by 'congestion' in nodes increases;

include mechanisms for deadlock control/ mechanisms to prevent/detect/avoid deadlock;
a situation that occurs when a process of transmission is in a wait state and some packets cannot advance toward their destination because are waiting on one another to release resources;

ensure integrity /accuracy/ completeness/ consistency/ validity of data;
by organizing data in a way that ensures the secure transmission between the origin/sender and destination/receiver;

12. (a) (i) *Award **[1 max]***

OR, AND;

(ii) *Award **[1 max]***

6, 3, 20;

(iii) *Award **[2 max]***
*Award **[1]** for the correct result (True) and award **[1]** for working.*

(6 > 6) OR (6 > 3) AND (6 + 6 < 20)
False OR True AND True
False OR True
True

(b) *Award **[4 max]***
*Award **[1]** for every two correct rows.*

MOTION	DOOR	WINDOW	SIREN
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

(c) (i) *Award **[1 max]***

Memory Data Register/ MDR;

(ii) *Award **[1 max]***

Control Unit/ CU;

(iii) *Award **[1 max]***

Arithmetic and Logic Unit/ ALU;

(iv) *Award **[4 max]***

Buses connect hardware components/ transfer information/signals between different components (CU, ALU, RAM, registers);
Address bus carries the address of the memory location from where data should be read/ written:
Data bus carries the actual data which need to be stored on/ written to the primary memory;
Control bus carries control/ timing signals from CU to other components;
Buses carry power supply to all components;

13. (a) *Award **[4 max]***

*Award **[1]** for initializing the **MEAN** (or any variable used for summing)*
*Award **[1]** for correct loop including correct use of counter, if any (for loop/while loop/ loop until)*
*Award **[1]** for correctly increasing **MEAN** by `DATA[K]` (correct use of array subscript)*
*Award **[1]** for calculating and outputting the **MEAN***

Example 1:

```
MEAN=O
loop K from 0 to N-1      //9 or DATA.length-1
    MEAN= MEAN + DATA[K]
end loop
output (MEAN / N)         // MEAN/10 or DATA.length
```

Example 2:

```
M = 0
K = 0
loop while K <= N-1     //9 or DATA.length-1
    M = M + DATA[K]
    K = K + 1
end loop
MEAN = M / N
Output MEAN
```

(b) (i) *Award **[1 max]***

Sorting algorithm;
Bubble sort;
Selection sort;
Insertion sort;
Shell sort;
Merge sort;
Quick sort;
Heap sort;

(ii) *Award **[10 max]***

Example 1 (Selection sort used to arrange the data values from lowest to highest value):

*Award **[1]** for correct outer loop*
*Award **[1]** for correct inner loop*
*Award **[1]** for Min initialized to R (within outer loop and before inner loop)*
*Award **[1]** for comparing DATA [C] with DATA [Min] and changing the value of Min (if needed)*
*Award **[1]** for comparing Min with R (after inner loop)*
*Award **[1]** for correct swap*

*Award **[1]** for checking whether N is an odd or an even number*
*Award **[1]** for calculating correctly MEDIAN (when N is an even number- two data values in the middle of array)*
*Award **[1]** for calculating correctly MEDIAN (when N is an odd number- one data value in the middle of array)*
*Award **[1]** for outputting MEDIAN*

```
//arranges data values from lowest to highest value
loop R from 0 to N-1
        Min= R
        loop C from R+1 to N-1
            if DATA[C] < DATA[Min]
             then
                Min=C
             end if
        end loop
        if Min != R
           then
            T = DATA[R]
            DATA[R] = DATA[Min]
            DATA[Min] = T
           end if
end loop
//calculates and outputs MEDIAN
if N mod 2 = 0
     then  //two data values in the middle
           //so the median is the mean of these two values
      MEDIAN = (DATA[N div 2]+ DATA[N div 2-1])/2
     else
     //median is the data value in the middle of the array
        MEDIAN = DATA[N div 2]
endif
output MEDIAN
```

Example 2 *(Bubble sort logic used to arrange the data values from lowest to highest value)*

*Award **[1]** for correct outer loop (either with a Flag or N-1 times)*
*Award **[1]** for correct inner loop (until N-2)*
*Award **[1]** for efficient outer loop (use of Flag, values changed correctly in all three places)*
*Award **[1]** for efficient inner loop (use of count or similar)*
*Award **[1]** for comparing DATA [I] with DATA [I+1]*
*Award **[1]** for correct swap*

*Award **[1]** for checking whether N is an odd or an even number*
*Award **[1]** for calculating correctly MEDIAN when N is an even number- two data values in the middle of array*
*Award **[1]** for calculating correctly MEDIAN when N is an odd number- one data value in the middle of array*
*Award **[1]** for outputting MEDIAN*

Sample

```
//arranges data values from lowest to highest value
count =0
Flag=True
loop while Flag
      Flag=False
      loop I from 0 to N-2-count
            if DATA[I] > DATA[I + 1] then
                TEMP=DATA[I]
                DATA[I] = DATA[I + 1]
                DATA[I+1] = TEMP
                Flag=True
            end if
      end loop
      count = count +1
end loop
//calculates and outputs MEDIAN
X = N mod 2
IND = N div 2
if X = 1
     then    //median is the data value in the middle of array
        MEDIAN = DATA[IND]
     else  //two data values in the middle
           //so the median is the mean of the two values
        MEDIAN = (DATA[IND]+ DATA[IND-1])/2

endif
output MEDIAN
```

Note*: Selection sort and bubble sort are on the syllabus. Other sorting algorithms are acceptable. In case that any other sorting algorithm appears in a candidate's response, contact your team leader for advice.*