

Markscheme

November 2023

Computer science

Standard level

Paper 1

14 pages



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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**".

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 <i>eg</i> "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 <i>eg</i> "explain two reasons …", mark the first two correct answers. This could include two full explanations, one explanation, one partial explanation <i>etc.</i>

General guidance

Section A

1. Award [2 max].

Application software cannot run on a particular CPU architecture; Software cannot run on an operating system; Computer hardware components may not run with a CPU architecture/bus/motherboard; Inability of software to interact with files; Different data representation (units/conventions i.e., dates/currency etc.);

Note: Reward other suitable answers.

2. Award [1 max].

Constant is a value of data which cannot be altered during execution of a program;

3. Award [2 max].

number of rejected/hypothesized words (speech commands); number of audio signal issues (users being either too loud, too slow or too fast/noisy environment – means decreased accuracy of speech recognition); difficulty distinguishing between similar sounding words; different dialects/accents which the system may not be able to deal with; limited database of commands;

Note: Accept other reasonable answers.

4. Award [3 max].

Data; Protocol; Packet number; Total number of packets; Sender's IP address; Receiver's IP address; Control bits/Parity bit/Check digit/Time to live (hop limit);

5. Award [3 max].

Award **[1]** for 5 correct rows in the truth table Award **[2]** for 6 or 7 correct rows in the truth table Award **[3]** for all 8 correct rows in the truth table

Α	В	С	A OR NOT B AND 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	

6. Award [2 max].

A virtual machine (VM) is an operating system (OS) or application; which imitates dedicated hardware (so that the end user has the same experience on a VM as they would on dedicated hardware);

A virtual machine (VM) is software that runs programs; without being tied to a physical machine;

The virtual machine is a form of software that allows running an operating system (OS); within another operating system;

Virtual machine is a software that allows running an OS other than the OS of the host machine; while hiding/abstracting the physical environment/OS of the host machine;

Note: Accept answers related to the Java virtual machine.

The VM is a platform independent execution environment; that converts (Java) bytecode into machine language and executes it;

The (Java) virtual machine is a program that provides run-time environment; in which (Java) byte code can be executed;

7. Award [3 max].

Fetches/extracts each instruction from memory; Decodes/transforms them into several commands/signals/steps (that are passed to the ALU or I/O or other components in the CPU for execution); Controls the movements of data within the CPU; Generates the clock pulses that regulates speed of the instruction cycle; Generates control signals for all hardware components to regulate their activities; Synchronizes all the operations of the CPU;

Note: Accept other reasonable answers.

8. (a) Award [2 max].

Concurrent processing means that a single or multiple system perform several tasks; simultaneously/within overlapping time frames;

Concurrent processing means execution of several algorithms/programs/sub-programs; At the same time (regardless of the number of processors);

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

Better use of (computer) resources; Decreased response time/waiting time/increased efficiency; Reduced overall run-time of the program; More real-world problems can be solved;

9. (a) Award [4 max].

Award **[1]** for a trace table with at least 2 columns (N, X, output) Award **[1]** for the correct column N Award **[1]** for the correct column X Award **[1]** for the correct output

N	Х	N>0	output
1216	0	True	
121	6	True	
12	7	True	
1	9	True	
0	10	False	10

Note: The trace table may be presented differently.

Alternate Mark Scheme: Award **[4 max]**. Award **[1]** for a trace table with at least 2 columns (N, X) Award **[1]** for the first two rows (with correct values of N and X) Award **[1]** for the next two rows (with correct values of N and X) Award **[1]** for the last row (with correct values of N, X and output)

(b) Award **[2 max]**.

Calculates/outputs the sum; Of all digits in \mathbb{N} ;

Section **B**

10. (a) Award **[2 max]**.

Passwords should be given to access certain aspects of the data; There should be levels of hierarchy (for example, the receptionist will be only allowed to access data such as names, addresses but not medical history/doctor's notes);

Multi-factor authentication/one-factor authentication;

which mandates for users (the doctor and receptionist) to verify their identities through various methods of validation (for example, PIN, incorporate thumb scanning or retina scanning technology)/which prevents random persons logging into the system;

Most security breaches are a consequence of human factors (negligence or simple "human" error);

This can be prevented by security awareness training for the doctor and receptionist/ precautionary measures when handling patient data;

Encryption;

makes it harder for hackers to decipher confidential patient data (if they manage to breach and subsequently gain access to the information);

Regularly installing updates/patches; To ensure the data is protected against new threats;

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

Human failure/error; Software corruption; Theft; Computer viruses/other malware; Hardware destruction; Data corruption;

(ii) Award [2 max].

Offsite/online backups/hard copy backups of patients' records should be made; To be used in case of system failure;

With data loss prevention software/backup software; That creates a file back/a copy doctor's files to a secondary device in an automated fashion;

Firewall and antivirus software/all the software; Need to be updated and properly maintained (to avoid corruption);

Training the staff with security practices; to avoid human errors;

Physical security; to protect against theft;

Maintaining the suitable conditions/following best practices for usage; to avoid hardware destruction;

Note: Reward other reasonable answers.

(c) Award **[3 max]**.

A mail-merge feature can be used to contact them;

The receptionist types the body of the letter (template)/prepares the letter for the patients; The database containing patient's records can be searched for the names and addresses of this type of patients;

To prepare the mailing list/table of recipients;

(d) Award **[4 max]**.

Security when working remotely;

VPN's data encryption features (putting data into a coded format so its meaning is obscured) allows the doctor to keep confidential information safe/VPN authenticates the user (doctor) before giving the access to data;

VPN allows access to any content in any place;

Because it enables users to send and receive data across shared or public networks as if their computing devices were directly connected to the private network;

VPNs hide the location/hidden IP address; making it seem as if she is accessing data from another place/location of the patient unknown for hackers/the MitM;

Protects the privacy of data;

A VPN will prevent apps and websites from attributing the doctor's behaviour to her computer's IP address/can limit the collection of the location and browser history from the Internet Service Provider(ISP);

VPNs usually have intuitive and user-friendly interface; So, it makes installation and use easy for the doctor (non-technical user);

VPN is adaptable to many smart devices/protects smart devices such as phones, tablets and laptops;

So, the doctor can use various devices/any available device;

Mark as [2] and [2].

(e) Award [3 max].

The network technologies available in the area (3G, 4G, 5G); Because of limited bandwidth; because the features of the doctor's device; because of the amount of data being transmitted;

because the number of other users in the area using the same network (during certain hours, there are many users, which causes the connection speed to slow down); because of the location of user with respect to cell towers (the speed may change because the signal varies depending on the coverage area);

11. (a) (i) Award **[1 max]**. Surveys/questionnaire; Observation;

(ii) Award [2 max].

Note: The answer to a(ii) should align with the answer to a(i).

Surveys are a practical/fast way to gather information from a large group of people about something specific in the company (which gives a good composition of data)/ anonymity (confidentiality) thus allowing the respondents to express their opinions freely/surveys provide fast results because of today's mobile and online tools this method of data collection can generate results quickly;

it is difficult/time consuming/costly/ineffective to collect all the specific data interviewing all the end users/analysis of collected data will take more time;

Observation allows the entire graphic design company to account for all processes (parts/participants)/gives more realistic view than interview/can highlight aspects that are not detected in interviews/helps to speed up the work of collecting information/ helps to prove or disprove an idea while keeping the overall costs of the collection of information down;

compared to interviewing many end-users which is costly/time consuming, etc.;

Note: Reward other suitable answers.

(b) Award [2 max].

Prototypes are simple representations of a system to demonstrate its functionality/user interface to the clients;

Used to evaluate a new design/to improve the accuracy/to collect data (with it the system analyst can survey clients/end-users to get feedback)/to ensure all essential functions of the system are present/meets the needs of the users;

(c) Award **[3 max]**.

Software needs to be tested with typical/extreme/invalid data so when the client (graphic design company) gets to use it most (or all) of the errors have been corrected; this can save money (if bugs are caught in the earlier stages, it costs much less to fix them); this adds to security/the client gets a trustworthy application (keeps client's information and data safe)/vulnerability free - problems and risks are eliminated beforehand;

this increases software quality/brings client satisfaction (best possible client experience); ensures the application's compatibility on many devices and operating systems (companies usually have many devices and tools available);

helps the application come as intuitive and user friendly as possible;

(d) Award **[3 max]**.

False advertising;

Images manipulated/edited/falsified;

And used to deceive people into supporting a product/brand;

Forgery;

Images of jewellery/fashion products/buildings/landscapes could be edited/falsified; For gain;

Fraud;

The image of an accident/happening can be changed/edited; To mislead police/an insurance company/public;

Copyright violation/Copyright infringement/Copyfraud; Copyrighted images used without permission of the copyright holder/without giving credit to the author; to profit from their efforts/which is plagiarism/which is unlawful;

Note: Award marks for **any** identified and fully explained problem in areas such as advertising, journalism, fraud, pornography, offensive imaging, etc.

(e) (i) Award **[3 max]**.

by compressing the file;

if the compressed file does not fit then split the file up into smaller parts; then attach each of the individual pieces to separate emails; the recipient would have to (download each attachment separately and then) use a file extraction program to extract the larger (divided-up) file, and piece it back together;

Accept examples, such as, use (file compression software like) 7-Zip to create an archive containing that 60MB file, splitting it into eight 7.5 MB pieces then use a file extraction program to extract file and piece it back together.

Use file-sharing services (Google Drive/OneDrive); upload the large file to the cloud; and share the link;

use an online storage service (that doesn't integrate directly with an email provider/ Dropbox);

upload the large file and "share link";

then just paste the link into your email (and the recipient will be able to access the file by clicking it);

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

Expensive hardware needed for high performance; Need for special skills in use of graphic design software; Unable to decode the file format; File corruption;

Note: Accept hardware or software examples, such as expensive colour printing, expensive high-resolution screens, high storage requirements, complexity/cost/limitations of graphic design software.

12. (a) Award [1 max].

Labar, Tanya or Tanya Labar;

(b) Award [3 max].

Award **[1]** for initializing all the variables used Award **[1]** for a correct loop. Award **[1]** for calculating sum using correct array index. Award **[1]** for calculating the average.

Example 1:

```
SUM=0
K=0
loop while K <= 9 //Accept SCORES.length()-1
    SUM = SUM + SCORES[K]
    K = K + 1
end loop
AVERAGE = SUM / 10 //Accept use of SCORES.length() or a counter variable</pre>
```

Example 2:

```
S=0
loop K from 0 to 9
    S = S + SCORES[K]
end loop
S = S / 10
```

(c) Award [4 max].

Award **[1]** for initializing and increasing counter if needed Award **[1]** for a correct loop Award **[1]** for a correct condition in if statement Award **[1]** for output

COUNT=0 loop K from 0 to 9 if SCORES[K]>AVERAGE then COUNT=COUNT+1 end loop output COUNT (d) Award **[7 max]**.

```
Award [1] for inputting a name and initializing all variables used
Award [1] for the correct loop
Award [1] for using a flag
Award [1] for calculating the middle index(MID) inside the loop
Award [1] for comparing NAMES [MID] with GYMNAST
Award [1] for changing the value of END if needed
Award [1] for changing the value of START if needed
Award [1] for the if statement after the loop
Award [1] for outputting either SCORES [MID] or an appropriate message
input GYMNAST
START = 0
END = 9
FOUND = False
loop while START <= END and NOT FOUND
    MID = (START + END) div 2
    if NAMES[MID] > GYMNAST then // method compareTo() may be used
         END = MID - 1
    else
         if NAMES[MID] < GYMNAST then
             START = MID + 1
         else
             FOUND=True
         end if
    end if
end loop
if FOUND then
    output (SCORES[MID])
else
    output (GYMNAST, 'this name is not found')
end if
```