

Markscheme

May 2026

Computer science

Standard level

Paper 1

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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**”.

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 <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>

Section A

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

Server/ Web server;
Email server;
DNS server;
Print server;
Database server;
File server;
Cloud server;
Proxy server
Router;
Gateway;
Client;
Firewall;

Note: Accept specific descriptions of the role.

2. Award **max** [1].

To translate (and execute) the high-level language code into machine code line by line / one statement at a time;

3. Award **max** [4].

Award **max** [2] for strengths and **max** [2] for limitations.

Strengths:

They provide immediate context-specific help;
Accessible at any time when using the program ;
The help files cannot be lost or forgotten as they are built into the software;
Give general instructions on how to use the program/ solve common errors/issues;
Can include interactive elements (such as hyperlinks, videos, and diagrams)
Can improve user understanding/productivity;
Not reliant on an internet connection (some software requires an internet connection but they don't have to);
The embedded help content is usually specific to the version of the software being used / they are usually updated when the software itself is updated.

Limitations:

Can only be used after system has been installed;
They don't give any help when installing the software (leaving users without guidance);
If the system is malfunctioning, accessing the help files might be impossible;
Often only deal with very general (common) errors;
Might lack a search capability so users have to look to find help for problems somewhere else;
It would take up additional storage space on the user's computer;

4. Award **max** [3].

Colours are represented numerically/binary/hexadecimal;

Primary colours: red, green, blue (One byte/8 bits/2 hexadecimal digits are assigned to each primary colour);

Combination of the three colour values (red, green, and blue) create a specific colour/ a specific colour is represented by 24 bits /3 bytes/ 6 hexadecimal digits/ hexadecimal values from 000000 to FFFFFFFF;

Colour intensity ranges from $0_{(10)}$ to $255_{(10)}$ / from $000000_{(16)}$ to $FFFFFF_{(16)}$ / Zero is completely dark and $255_{(10)}$ is as bright as possible in that colour (white);

The number of possible combinations: 2^{24} /16777216/ 16^6 colours;

Note: Accept 48 bits for representing a colour, 16 bits for each intensity of red, green and blue, range 0 for dark and 65 535 as bright as possible in one colour, and 2^{48} possible combinations because modern colour system uses 48 bits.

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

Hard drives/SSD/Backup storage devices;

Output devices/printers/speakers, etc;

Input devices/scanners/mice/keyboards/game controllers, etc.;

Database/data files/folders;

Software/Applications/OS;

Internet connection;

Server/ Mail Server/ File Server/ *other services*;

Bandwidth;

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

Digital subscriber line (DSL) that uses existing telephone line/ADSL/SDSL;

Fibre optic cable;

Mobile data /cellular data (5G) /satellite link/ wireless (via cell-based towers);

6. Award **max** [6]

Example 1 :

Award [1] for each correct row (rows 2-7).

N	N > 0	Z	R[0]	R[1]	R[2]	R[3]	R[4]
5			25	24	17	11	14
4	TRUE	4					4
3	TRUE	1		3			
2	TRUE	2			2		
1	TRUE	3				1	
0	TRUE	0	0				
	FALSE						

Example 2 :

Award [1] for each correct row (rows 2-7).

N	N > 0	Z	R[0]	R[1]	R[2]	R[3]	R[4]
5			25	24	17	11	14
5	1	4	25	24	17	11	4
4	1	1	25	3	17	11	4
3	1	2	25	3	2	11	4
2	1	3	25	3	2	1	4
1	1	0	0	3	2	1	4
0	0		0	3	2	1	4

Note: The trace table may be differently presented. Accept 1/Yes and 0/No instead of True/False.

7. Award **max** [4].

Award [1] mark for every 2 correct rows in the truth table, ×4.

A	B	C	Z
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

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

The process of testing a software product in a real-world environment/
performed by (end) users to identify bugs or issues / to get feedback from (end) users;
before its official release;

Section B

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

Might not meet the needs/expectations of employees/clients;
Might not be technically possible;
Might not comply with laws and regulations;
Development cost might be higher than expected / over the company's budget;
Might take too long to design/implement;
Might be too complicated to use/ run;
Better alternative might be found during evaluation;
Might need more training/skills than planned;
Might create security/reliability/compatibility/usability problems;

Note: Reward other reasonable answers such as poor usability, compatibility issues, security issues, slow/unstable- poor performance.

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

Award up to [2] for strengths and up to [2] for weaknesses.

Strengths:

The new system can be evaluated with no consequences in case of failure (as it can fall back on the old system)/ Reduces risk of data loss during migration as both systems maintain records;
Staff can learn how to use the system at a pace;
Safer/secure/less risky, every transaction can be compared with the results of the old system/ enables performance/efficiency comparison with the old system;
Errors and bugs in the new system can be detected/fixed without downtime as the old system is running in parallel;
It can be cheaper running two systems simultaneously than losing all data in case of failure;

Note: Reward other reasonable answers.

Weaknesses:

It can be costly as two systems should be maintained/ more staff should be hired (trained);
The systems cannot be synchronized with each other;
Double data entry increases the chance of mistakes/inconsistencies/mismatched records between systems;
Having to do everything twice slows down the process/ increased employee workload;
Time consuming to complete the implementation of the new system/ to fully replace the old one adopting the new system;

Note: Reward other reasonable answers.

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

Internal/insider security threats; *Accept answers such as data theft, sabotage from employees. Cyberattacks caused by human error; Accept answers such as careless decision-making, weak passwords, data leaks.*

Third-party security breaches; *Accept answers such as a cloud provider storing this data can be hacked, security hacking attacks.*

Man in the middle attacks (data interception during transmission);

Malware/viruses/malicious software; *Accept answers such as programs used to gather information through compromised devices, attached to downloadable files from emails or websites to disrupt network traffic/steal data, phishing scams.*

Ransomware (software that encrypts files/data and holds them for ransom forcing victims to pay for a decryption key to unlock the data);

SQL injections (a malicious SQL code inserted into user-input fields to read/modify/delete data in a database) / cyberattacks that exploit vulnerabilities in web applications/manipulate databases;

Distributed denial-of-service (DDoS) (attacks that causes websites to crash);

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

Email server manages the flow of messages between email clients and the internet;

Email server is responsible for processing and delivering incoming emails to the appropriate recipients and relaying outgoing emails to their intended destinations;

Email server handles the sending/receiving/storing email messages;

Email server manages user accounts and their mailboxes/ verifies sender and recipient identities (to prevent misuse)/ filters spam/blocks malicious emails/prevents unauthorized access;

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

All messages that have been sent and received can be stored and searched through/email allows for easy referencing/ record keeping;

Email allows for the mass sending of messages/one particular message can be sent to several recipients at once;

Email allows automated reminders/automated replies/personalized invitations/embedded surveys/feedback forms;

Employees can read and respond at convenient times/ supports remote jobs/allows secured world-wide communication;

Large amounts of data/attachments (documents, images, videos) can be quickly transferred/ accessed from any device;

Hard copy of the message can be obtained;

Email is paperless, so not harmful to the environment/ eco-friendly;

Email is free/ simple to use/ cost effective/ quickly delivered;

Note: *Reward other reasonable answers.*

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

Award [1] mark for the reason why it is needed, award [1] for an expansion and award [1] for further elaboration.

Example 1:

Encryption ensures data confidentiality / only the intended recipient can understand the data / protection of sensitive data;
as encryption transform a plaintext message into a scrambled ciphertext format;
so that the message cannot be understood without the decryption key;

Example 2:

Encryption is needed to help maintain data security/ support legal/regulatory compliance;
as encryption involves using an algorithm and a cryptographic key to alter data/text;
so that even if intercepted, the message cannot be understood without the decryption key;

Example 3:

Encryption is needed to secure all outgoing and incoming email communication;
The channel used to send email to the recipient can be encrypted using Transport Layer Security (TLS);
to provide confidentiality / integrity/ authenticity;

10 . (a)(i) *Award **max** [3].*

*Award [1] for each clear difference between primary and secondary memory, **x3**.*

Primary memory stores data permanently (ROM) or temporarily (RAM), whilst secondary memory stores data permanently/ Nature of parts of primary memory varies (RAM- volatile, ROM- non-volatile), secondary memory is always non-volatile (data is retained even after shutdown);

CPU can directly access the data stored in primary memory (RAM), CPU cannot directly access the data stored in secondary memory;

RAM holds the data/programs that the computer is currently using/ holds the data while it is being executed by the CPU whilst secondary memory holds programs/data when not in use (various types of data/programs: OS, applications, videos, images, etc.);

Primary memory provides fast access to data/instructions, secondary memory provides slower access (compared to primary memory);

Storage capacity of the primary memory is limited/less capacity, secondary memory has more storage capacity;

Primary memory examples: RAM/ROM/cache memory/registers, secondary memory examples: hard disk drives (HDDs)/solid-state drives;

Primary memory is more expensive per unit of storage (due to high speed and complexity), secondary storage is more affordable per unit (making it suitable for bulk storage);

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

Award [1] for a function and award [1] for a reasonable expansion, ×2.

Memory allocation/OS allocates a portion of memory/ the computer's RAM to each running program;
which ensures that each program gets the memory it needs;

Memory deallocation/after execution of the program this memory is reallocated/
freed/OS releases the memory the program was using;
making it available for other programs;

Memory protection/OS safeguards memory space/OS prevents one program from accessing
or modifying the memory assigned to another program;
ensuring data integrity and security;

OS maps logical addresses (used by programs) to physical addresses (used by the hardware);
ensuring that the program can access the correct physical memory location;

OS keeps track of primary memory/of which bytes of memory are used by which user
program/of memory addresses that have already been allocated and the memory addresses of
the memory that has not yet been used;
To ensure efficient utilization of available memory;

OS controls how much memory a program can use/ which pages to load which pages to store
on disk;
to optimize memory usage;

Virtual memory management/ using disk space as an extension of RAM;
to run larger programs/more programs simultaneously;

Paging (a process is divided into fixed-size blocks called pages/physical memory is divided into
frames of the same size);
allows efficient utilization of memory/ supports execution of large programs/ enables dynamic
memory management;

Swapping (OS memory management technique where processes are moved between main
memory/RAM and secondary storage);
allows the system to handle more processes than the available RAM can support/ prevents
crashes by providing additional memory when RAM is exhausted/ enables memory-intensive
programs to run on systems with limited RAM;

Note: *Reward other correct responses.*

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

Holds data/instruction read from/to be written into the main memory/RAM;

- (ii) *Award max [3].*

Cache memory acts as a buffer between the main memory and the CPU/ is placed between the main memory and the CPU/ is located closer to the CPU;

Cache memory is a high-speed memory (high-speed SRAM technology)/ significantly faster than RAM (DRAM technology);

It stores the data/instructions that the CPU uses more frequently;

For any data, the CPU first checks the cache and then the main memory;

which decreases the average time to access the main memory (data)/ improves overall system performance;

- (iii) *Award max [4].*

A system of communication paths used to connect various hardware components (CPU, memory, and input/output devices);

Bus enables the transfer of signals/data between these components ensuring smooth operation/efficient use of resources during fetch-execute cycle;

Two types of buses listed (data bus, address bus, control bus);

Data bus carries data between the CPU/ memory / I/O devices;

Address bus carries the physical location (address) of data to be accessed or written by the CPU;

Control bus transfers control signals for coordinating the overall system's operation;

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

3;

- (b) *Award max [4].*

Award [1] for initializing and increasing counter.

Award [1] for a correct loop.

Award [1] for the correct comparison.

Award [1] for output after the loop.

Example:

```
C = 0
loop G from 0 to 8 //Accept TA.length-1 or OP.length-1
  if TA[G] = OP[G] then
    C = C + 1
  end if
end loop
output (C)
```

(c) Award **max** [6].

Award [1] for initializing maximum/best winning margin.

Award [1] for looping through games.

Award [1] for calculating margin.

Award [1] for comparing maximum/best winning margin with current margin.

Award [1] for changing best winning margin if needed.

Award [1] for outputting maximum/best winning margin.

Example:

```
MAXWM = 0
loop G from 0 to 8 //Accept TA.length-1 or OP.length-1
  if TA[G] > OP[G] //optional condition
    then
      WM = TA[G] - OP[G]
      if MAXWM < WM then
        MAXWM = WM
      end if
    end if
  end loop
output (MAXWM)
```

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

Award [1] for initializing and outputting total.

Award [1] for looping through games.

Award [1] for increasing total by 3 if team TA won.

Award [1] for increasing total by 1 if neither team won.

Example:

```
TOT = 0
loop G from 0 to 8    //Accept TA.length-1 OR OP.length-1
  if TA[G] > OP[G]
    then
      TOT = TOT + 3
    else
      if TA[G] = OP[G]
        then
          TOT = TOT + 1
        else //may or may not appear
          TOT = TOT + 0
        end if
      end if
    end if
  end loop
output (TOT)
```
