2225 – 6417M

Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2025

Computer science

Standard level

Paper 1

TZ1/2

15 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 **max** [2].*
GUI components (tabs, buttons, scroll bars, icons, pointers, windows);
Toolbars;
Menus;
Dialogue boxes;
Simplicity;
Intuitiveness / user friendly/ intuitive and easy to use;
Consistency;
Clarity;
Attractiveness;
Responsiveness;
Familiarity;
Accessibility;
Efficiency
Customization;
Note: *Reward other correct answers.*

2. *Award **max** [3].*
Award [1] for a reason/example/scenario where VPN is relevant.
Award[1] for a feature of VPN (encryption, tunnelling, leak protection, data or bandwidth caps, zero-logs policy, IP shuffling, kill switch). (Accept either a term/name or a description of a feature.)
Award[1] for an elaboration.

***Note**: The reason/example/scenario, feature and elaboration must work as whole coherent answer. The following answers are only examples there could be other appropriate answers.*

Employees may use a VPN to access company's network/internal resources/databases/ from remote location:
VPN creates a tunnel;
allowing secure connections and access (based on employees' roles);

Users who need a secure/private communication may use VPN;
VPN encrypts data;
and prevents hackers from intercepting sensitive information.;

Users of insecure public Wi-Fi/ safer browsing while on public Wi-Fi;
logging in on their socials/ purchasing something online/ leaving credentials;
VPN lets connect to the provider's servers creating a private tunnel that secures data;

Users may use a VPN to give themselves more privacy/ anonymity online/ avoid geographical limitations;
IP address is masked so the location of the user is not known;
So they can visit websites that are restricted by location/ online businesses use geographic segmentation which means prices of product that can be bought and sold (books, airline tickets, clothes) vary depending on the buyer's location/ may be essential if a country is likely to block internet content from foreign entities, for example, journalists could use a VPN to look like they are within that country (*Accept any legitimate reason for needing to be unknown*) ;

Use of a VPN during days and times when a lot of people trying to stream content and download files at the same time / to avoid congestion (during peak times of internet usage);
With a VPN user can choose what network their traffic travels on;
So, VPNs can (sometimes even) increase the internet speed;

VPNs can be used for bypassing network restrictions;
to access certain blocked websites;
VPNs can tunnel around the restrictions;

Internet/social media users (streaming, online gaming, etc.) may use VPN to avoid tracking/surveillance;
because VPN hides the type of traffic;
and it can prevent the risk of getting frequent advertisements/ the risk of bandwidth throttling (slowing down) by ISP provider;

3. *Award **max** [4].*
*Award[1] for an advantage and [1] for a description, **x2**.*

Fast /cost effective/flexible way of gathering data;
from large number of users/ surveys can be sent out as offline or online form (for better reach);

Standardized question formats;
can yield more reliable data than other methods (interviews, observation, etc.);

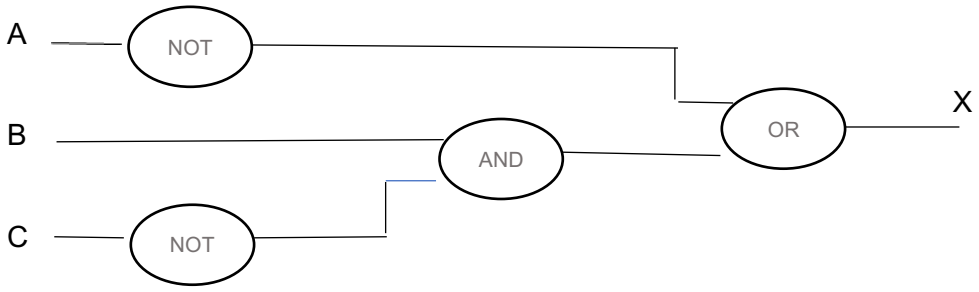
Anonymity/ privacy for respondents;
can lead to more honest responses;

Simple to administer (less time consuming than other methods);
A large amount of data gathered in a short period of time;

Fast results/ easy to extract quantitative data/ easy to analyse data;
because all the users are asked the same questions;

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

4. *Award **max** [4].*
Award [1] for each of the correctly placed logic gates.
***Note:** Each logic gate needs to have the correct input(s) and output.*



5. *Award **max** [6].*
Award [1] for a trace table with at least 4 columns, excluding the output column.
Award [1] for each correct column (column heading: N, S, R, A, output, see the example)
***Note**: The trace table may be differently presented.*

N	S	R	A	output
5	0	0	2	
4	1	1	1	
3	5	6	0	
2	2	8	2	
1	3	11	1	
0	4	15		The result is 15

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

Parallel running;
Pilot running;
Direct changeover;
Phased conversion;

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

Example answers:

contains a database of public IP addresses and their associated hostnames/domain names;
translates/matches those website hostnames to their corresponding IP addresses;

translates human-readable domain names (like www.ibschool.com) into machine-readable IP addresses (like 2001:0db8:85a3:1111:0000:8a2e:0380);
allows users to access websites by using meaningful names (instead of IP addresses which are difficult to remember) /presents the corresponding web page of the domain name entered by the user;

acts like a directory of webservers on the internet;
lets web browsers connect to the web servers;

converts human-readable domain names into IP addresses;
ensures that internet traffic reaches the correct destination based on the domain name;

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

8. (a) *Award **max** [1].*
F3A;

(b) *Award **max** [1].*
2^{12}/ 4096;

Section B

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

software used (by designers) to create 2D/3D models of physical components/software used to simulate hand drawn sketches or component parts of an entity (machine, vehicle, etc.);
software that is used to create / modify / analyse / enhance a design;

(ii) *Award **max** [4].*
*Award [1] for a benefit and [1] for a reasonable expansion, **x2**.*

Example answers:

Increased productivity;
CAD software automates most of the architect's tasks which allows quicker project completion/ the same amount of time can result in a greater number of completed projects;

Flexibility to modify designs;
Allows for changes and revisions to be visualized and approved;

Decreased architect's effort;
the different parts of code and drawings can be modified easily then reused multiple times;

Saves time;
Easy/quick to create/edit/ make alterations in the drawings;

Saves cost/money;
a model could be created using CAD, and modified before the real thing is produced (if it does not work, it could cost the architect more money to create again);

Better quality of drawings;
The CAD makes use of best tools (that allow creation of precise complex drawings of surfaces and shapes);

Improved accuracy;
CAD tools include many mathematical equations that perform vital calculations/examine curves/surfaces;

Fewer errors;
the CAD software makes use of tools to investigate an error, diagnose the problem, and solve it;

Easy to share work with colleagues/clients;
The CAD tools make it easier to save the files and store it in a way that they can be used again and/or sent;

Integration with other tools;
CAD designs can be given to a 3D printer or CAM for direct implementation;

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

(b) *Award **max** [3].*
To reduce the size of files;
so that less memory space on the architect's computer is occupied/ more CAD files can be stored in the available memory;
faster upload/download/ transmission time reduced/ improved data transfer speed;
easier to meet attachment size restrictions/ reductions in communication bandwidth (capacity for the data transfer):
meaning a significant decrease in expenses;

(c) (i) *Award **max** [3].*
Award [1] for a reasonable method;
Award [1] for indicating how downtime is minimized;
Award [1] for indicating how data is made available;

Example answers:

A regular/periodical back up;
stored on external storage devices;
data could be quickly recovered

A secondary system/ a standby computer (or only duplicate disks and a processor);
with an appropriate backup system;
that might take over with data quickly restored to the last point it was backed up;

A failover system/RAID;
that automatically takes over;
with no data loss;

in case of a hard drive failure not all of data is erased/damaged;
she can (buy and) use a data recovery software/ hire a skilled data recovery service;
this will enable recovery of as much data as possible, but it takes time;

Cloud Storage/ the architect can save/back up all files to the cloud (A*ccept examples, OneDrive, Google Drive, etc.*);
and can access them from any device/anywhere;
anytime/when required/when disk fails;

(ii) *Award **max** [4].*
*Award [1] for a cause and [1] for a reasonable expansion, **x2**.*

Human errors;
Data may be accidentally deleted/ entered/ altered inaccurately/ files may be wrongly replaced/ files might not be saved;

Transfer errors;
Data may be lost in transit between two systems (such as a network failure, network congestion, incorrect storage destination, between two physical locations- transporting a backup / storage device to another location);

Computer viruses/ malicious acts/ malware/ hacking;
Can steal/ alter/ destroy data;

Software malfunction;
an application used for requesting/editing data can crash resulting in data loss;

Natural disasters (for example, floods, earthquakes, hurricanes, cyclones, fires, lightning);
that can damage on-premises software/hardware and lead to data loss;

Power failures;
can damage operating system resulting in data loss;

Disk full / no available space on the disk;
prevents new (or updated) data from being saved leading to data loss;

Lossy compression;
compressed file does not restore/rebuilt in its original form;

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

10. (a) *Award **max** [6].*

Example 1:

Each user should be assigned a user role (administrator, student, teacher, guest);
Each user must have a unique username and password;
Different access levels could be implemented by using password/ authentication (PIN/ token/ biometrics/ two-factor authentication (2FA) before accessing a file/ through whitelisting/blacklisting devices/ by verifying MAC addresses;
Users assigned an administrator role have full access to the system/ are allowed to perform most operations on the system (such as, add, remove, edit users, groups, domains, manage passwords, configure services, etc.);
Users assigned a teacher role have read-write access to update student grades/ read-only access to students' records/ no access to other teachers' financial records;
A user assigned a student role has read access to his reports / no access to other students' /teachers' data;
A user assigned a guest role has restricted/limited access to certain file/folders/information / no access to the files with sensitive or personal data/ users with guest accounts can only read from files containing general info/ guest users cannot perform any actions/ guest users can only browse the internet);

Example 2:

Create a Virtual Local Area Network (VLAN) that allows segmentation of different user groups;
Each VLAN uses strong authentication/ user logins /two-factor authentication;
Each VLAN can have specific security policies/ rules and restrictions;
Implement Access Control Lists (ACLs) on devices/ define what resources each group of users can access/ assign permissions based on user roles (RBAC);
Administrators have full access to all resources;
Teachers have access to their personal records/teaching materials/authorized student data;
Students have access only to their own files/ assignments/ reports / no access to others' data;
Guests have internet access only/ restricted access through firewall and ACLs / no access to sensitive information;

Example 3:

Intranet and extranet could be implemented;
The intranet is restricted to group of users related to school(administrator/teachers/students);
Each teacher/student has login, password (and permissions);
Administrators have full access to all resources (intranet and extranet);
Teachers have access to their personal records/teaching materials/authorized student data;
Students have access only to their own files/ assignments/ reports;
Extranet is accessible to all (administrator/teacher/student/guest) / Extranet provides limited access from outside the LAN for all users working remotely;
Guests have access to Internet;

(b) (i) *Award **max** [2].*
Award [1] for a communication link and [1] for a reason/ justification.

Fibre-optic internet;
Because data transmission is fast/ reliable;

Coaxial cable (Cable internet);
Because it is (still) one of the fastest internet types / is significantly faster than DSL/ practical because it uses the same coaxial connections as phone services/ cable TV;

5G wireless broadband/mobile internet;
Because of greater speed in the transmissions/ a greater number of connected devices/ the possibility of implementing virtual networks;

Satellite link;
higher data transmission rate/ better coverage;

(ii) *Award **max** [4].*
*Award [1] for a security measure and [1] for justification, **x2**.*

Enable firewalls;
To monitor/prevent unauthorized access to the network/ to alert network administrators to any intrusion attempts/ to monitor all the incoming and outgoing traffic of the school network/ to set the rules to blacklist certain website;

Router/access point can be configured;
to allow only pre-approved MAC addresses (approved by network administrator) to connect to the network/ whitelist/blacklist filtering;

Fibre optics ;
To reduce the chances of interception/ more challenging for hackers to intercept;

Install new updates/ enable automatic updates (OS/firmware/apps, whenever/wherever possible);
to ensure running the latest/most secure versions;

Use encryption;
if cybercriminals gain access to the network, files encryption prevents them from reading/understanding any of sensitive information;

Install an antivirus program on all computers;
run or schedule regular virus scans to keep computers virus-free;

Install anti-spyware software;
that records/prevents/removes every attempt/keystroke to gain access to passwords/ other sensitive information;

Train/educate users (teachers, students);
to use complex passwords/ to update passwords on regular basis/to ignore email messages from unknown parties and never click on links or open attachments that accompany them;

Use multi-factor authentication (MFA)/ two or more different types of actions to verify identity;
to defend against the of password-related cyberattacks;

Use of VPN;
ensures secure access through encryption / tunnelling;

A captive portal/ implement an authorisation online portal;
Newly connected users should enter password/user ID before they are granted access to network resources;

Note*: Do not accept backup as a method as it does not prevent the threat.*

Note*: Reward other reasonable responses.*

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

emails may fill the storage available;
emails may overload the internet connection/ emails with larger file transfer can utilize a lot of network bandwidth;
phishing attacks/ potential data leak-students click link in emails/visit an infected website;
downloading of viruses or worms from emails corrupting the whole network;
if email accounts are compromised, attackers could gain access to school systems/ distribute malware across the network;
inappropriate messages may be sent within/ outside the school/students may use it for bullying;
e-mail messages could be used to cheat on exams/ assignments;
teachers/ students may become vulnerable to email from strangers/ a risk of sending/receiving offensive/ inappropriate/ harmful content through email;
inappropriate use of school email for personal communication;
many email accounts can increase the workload for IT staff/ more IT support/ monitoring/ maintenance needed;
increased costs (for licensing, email server, etc.)

Note: *Reward other reasonable answers.*

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

(ii) *Award **max** [1].*
7;

(iii) *Award **max** [1].*
5;

(iv) *Award **max** [1].*
60;

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

Award [1] for a correct loop;
Award [1] for checking if a failing grade;
Award [1] correct indexing used to access values in at least two arrays;
Award [1] for initializing and incrementing (if needed) the index (`I`) in the array `RESIT`;
Award [1] for correctly assigning the name from the array `STUDENTS` to the array `RESIT`;

Example 1 (uses the `MARKS` array):

```
// assume:  the array RESIT of sufficient size is initialized
//  the minimum mark for grade 2 (passing grade) is 10
I = 0
loop K from 0 to 199  //Accept len(STUDENTS)-1 or STUDENTS.length()-1
    //accept any correct loop through the array MARKS
    if MARKS[K] < 10
        then
            RESIT[I] = STUDENTS[K]// Accept RESIT.append(STUDENTS[K])
            I = I + 1
    end if
end loop
```

Example 2 (uses the `GRADES` array defined in part(a)):

```
// assume: the array RESIT of sufficient size is initialized
// grade 1 is a failing grade
I = -1
loop K from 0 to 199 //Accept len(STUDENTS)-1
    //accept any correct loop through the array GRADES
    if GRADES[K] = 1
        then
            I = I + 1
            RESIT[I] = STUDENTS[K]// Accept RESIT.append(STUDENTS[K])
    end if
end loop
```

Note : Collection methods not accepted.

(c) *Award **max** [7].*

*Award **max [3]** for the calculation of the average mark. [1] for initializing sum and adding Marks[k] to the sum, [1] for a correct loop, [1] for the sum divided by 200;*
*Award [**1**] for a correct second loop;*
*Award **[1]** for correct use of indexing in both MARKS and LETTERGRADES array;*
*Award **max [3]** for determining each letter grade. [1] for each condition and grade assignment (String) to the LETTERGRADES array **x3**;*

```
//calculate the average mark
Sum=0
loop K from 0 to 199   //Accept len(STUDENTS)-1 or STUDENTS.length()-1
    Sum = Sum + MARKS[K] // Accept any correct loop
end loop
AVE = Sum / 200   //accept SUM DIV 200

K=0
loop K from 0 to 199   //Accept len(STUDENTS)-1 or STUDENTS.length()-1
        // loop through the array MARKS
        // accept any correct loop
    if MARKS[K] > AVE + 20        //determine the grade
        then
            G = "A"
        else
            if MARKS[K] < AVE - 20
                then
                    G = "C"
                else
                    G = "B"
            end if
    end if
    LETTERGRADES[K] = G
end loop
```

Note : Collection methods not accepted.
Alternate selection constructs accepted provided it leads to the correct grade assignment