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ASSUMPTION CONVENT SCHOOL
Information Technology
PRELIM EXAMINATION - THEORY PAPER
8 September June 2023



Pupil's Name & Surname			12
Examiner	Cluster		Cluster
Venue			1
Total marks	150		3 Hours
No of Questions	6		23 (incl. Appendix A)

- Read the questions carefully and make sure that you answer all parts of all the questions.
- Answer on the question paper. Please make sure that you write your name in the block above.
- Show all working where applicable.
- A non-programmable calculator may be used.
- Write legibly and to present your work neatly.
- THREE blank pages (page 20, 21 and 22) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the number of your answer should you use this extra space.
- Detach and use **Appendix A** to complete the trace table for **Question 6.5**.

Question	Marks	Student Mark
1	10	
2	10	
3	29	
4	38	
5	12	
6	52	
TOTAL	150	

QUESTION 1:**TERMINOLOGY****10 MARKS**

Give the most appropriate term for each of the following descriptions:

1.1 Software embedded on a hardware component.

(1)

1.2 A signal sent to the CPU from a program to indicate the process has encountered a run time error.

(1)

1.3 An attack on a website from multiple devices to ensure the website is unavailable.

(1)

1.4 An electrical device that provides emergency power to electrical equipment when the primary power source fails.

(1)

1.5 A type of processing where a single CPU can only process one instruction at a time.

(1)

1.6 A single application with multiple parts that can be executed simultaneously.

(1)

1.7 A commonly used networking cable that consists of several intertwined pairs of cables

(1)

1.8 A technique that uses a person's physical characteristics for identity verification/authentication.

(1)

1.9 A form of cache where recently accessed web pages are stored on a local server.

(1)

1.10 A technique to reduce the size of a file or app

(1)

QUESTION 2:

MATCHING COLUMNS

10 MARKS

For each of the terms in Column A below, select the **most correct** definition in Column C, matching the letter to the question number.

Column A	Answer	Column B
2.1 Digital Signatures		A Wireless Internet access provided by a network device.
2.2 AUP		B A motherboard bus to connect SSD devices.
2.3 Certificate Authority		C System software that controls a peripheral on a computer.
2.4 Onion Routing		D A device that uses a network server's CPU and RAM to process tasks.
2.5 BitTorrent		E A design principle where computers are built with easily replaceable parts.
2.6 Modular Design		F Transfer protocol that is peer-to-peer.
2.7 Hotspot		G Confirms, using cryptography, that a document originated from a particular user.
2.8 Device Driver		H An entity that stores, signs and issues digital certificates.
2.9 M.2		I A document that states the rights of the developer and user of a piece of software.
2.10 Thin Client		J A protocol that allows anonymous browsing using multiple layers of encryption.
		K A cable-less hardware specification for internally mounted drives.
		L A document stipulating constraints and practices for users in an organisation.
		M A device that uses its own CPU and RAM to process tasks.
		N A group of hard-wired devices.
		O A network device that provides a wireless connection to mobile devices.

(10)

SCENARIO:

Maths, Science and Information Technology are becoming the dominant focus in education.

Mr. Jones is responsible for building three new schools to promote Maths, Science and Information Technology. These schools will be based in Durban, Johannesburg and Cape Town. All schools will have one IT room with LAN-connected high-end computers. The IT computers at each school will communicate with the Johannesburg campus, where a file server will store all the learner's files.

David, a Grade 12 student, will be assisting Mr Jones with setting up the three IT centres.

QUESTION THREE**SYSTEM TECHNOLOGIES****29 MARKS**

David is considering the following laptop to be used in the IT rooms:

CPU: Intel 12th Gen Core i5-1235U 3.30GHz
(10 Cores, 12x Threads, 12MB Cache)
Memory: 4GB DDR4 Memory
Hard Disks: 512GB Ultra-Fast NVME SSD,
1TB SATA HDD
Graphics Card: GeForce RTX 4060 with GPU and VRAM
LAN: Ethernet 10/100/1000Mbps
USB: 2 x USB 3.1 Type A
1 x USB 3.2 Type-C
HDMI: 1 x HDMI
Screen: 14 inch 1920 x 1200 Display
Operating System: Windows 11 Professional (64bit)

3.1 This laptop has a Windows Operating System.

3.1.1 Name ONE other example of an operating system besides Windows.

(1)

3.2 This CPU has 12MB of cache.

3.2.1 Define processor cache.

(2)

3.2.2 Give TWO ways that processor cache improves CPU processing speed.

1:
2:

(2)

3.2.3 State ONE reason why the size of the processor cache is smaller than the size of RAM.

(1)

3.3 Differentiate between multiprocessing and hyperthreading.

Multiprocessing:
Hyperthreading:

(2)

3.4 Students will use these laptops for programming and running 3D simulation software. Mr Jones says that 4GB RAM will not be sufficient.

Suggest a minimum amount of RAM and explain why the student will need more RAM.

Minimum amount of RAM:
Explanation:

(2)

3.5 David suggests that overclocking will improve the laptop's performance.

3.5.1 Define overclocking.

(2)

3.5.2 Give TWO risks/side effects associated with overclocking.

Risk 1:
Risk 2:

(2)

3.6 There are TWO secondary storage drives listed in the laptop specifications.

3.6.1 Choose which is the better drive. Place a cross next to your chosen answer.

SSD

☐

HDD

☐

(1)

3.6.2 Justify your answer to Question 3.6.1 with ONE reason.

(1)

3.6.3 On which drive should the Operating System be installed?

Place a cross next to your chosen answer.

SSD

☐

HDD

☐

(1)

3.6.4 Justify your answer to Question 3.6.3 with TWO reasons.

(1)

3.7 David suggests that students in the school be involved in gaming competitions.

3.7.1 Which component in the specifications would assist the most in gaming?

--

(1)

3.7.2 Give TWO ways this component will improve gaming performance.

1:
2:

(2)

3.8 This laptop has an HDMI port. What data is transferred through an HDMI port?

(2)

3.9 The Front Side Bus (FSB) communication between the CPU and other motherboard components.

3.9.1 Explain how the number of bits in the address bus affects how much RAM the CPU can address. Show any formula needed in your explanation.

(2)

3.10 David has been asked about programming in Java.

3.10.1 Explain how Java is both compiled and interpreted.

(2)

- 3.10.2 David wants to code a Java inventory application to store the details of each laptop in the three the IT centres. He is thinking of selling the executable version of his program.

What licencing model should he choose to sell his executable version?

--

(1)

- 3.10.3 Give ONE reason to explain your answer in Question 3.10.2.

(1)

QUESTION FOUR: INTERNET AND NETWORKING

38 MARKS

- 4.1 David is concerned about the possible loss of the learner's data on the file server and suggests RAID as a solution to the problem.

- 4.1.1 Explain how RAID is different from backing up data.

RAID:
Backup:

(2)

- 4.1.2 Suggest the type of RAID that should be used on the file server if the file server has 2 identical hard drives.

--

(1)

- 4.1.3 Explain how the type of RAID you chose in Question 4.1.2 will work.

(2)

- 4.2 The learner's data stored on the file server is becoming too large. The solution is to store the data on the local computers in the IT labs or use remote cloud storage. Use the table below to provide an advantage and a disadvantage of both solutions.

Your answers may not be the opposite of each other.

	Store data locally	Cloud storage
Advantage		
Disadvantage		

(4)

- 4.3 It has come to the school principal's attention that his password-protected data stored on his school computer has been accessed.

The principal suggests removing all remote access to the school's computers and laptops to solve the problem.

4.3.1 Define remote access.

(2)

- 4.3.2 Do you think removing remote access to the school's devices will stop access to his password-protected data.?

Place a cross next to your chosen answer.

Yes

☐

No

☐

(1)

- 4.3.3 Justify your answer to Question 4.3.2 with TWO reasons.

1:
2:

(2)

4.3.4 Give TWO ways that a VPN is different to remote access.

1:
2:

(2)

4.3.5 Give TWO solutions to ensure the principal's private data is inaccessible on his local computer.

1:
2:

(2)

4.4 David decides to make his program Question 3.10.2 web-based so users can add, edit, and delete each computer's details in a web browser. The application will have the URL <https://davidsapp.co.za>. Users will open the website and log in with their email address to access the application.

4.4.1 Is this an example of the deep web or the dark web?

Place a cross next to your chosen answer.

Deep web

☐

Dark web

☐

(1)

4.4.2 Justify your answer to Question 4.4.1 with TWO reasons.

1:
2:

(2)

- 4.4.3 The IP address of the website is 43.96.101.5, and the IP address of David's computer is 198.1.3.22. David receives an email data packet from the website.

Complete the packet below using the provided IP addresses by filling in the missing information marked **A**, **B**, **C** and **D**. Write your answer next to the correct letter in the table below.

Header	A
	B
	Protocol
	Packet Number
Payload	C
Trailer	Data to show end of packet
	D

(4)

- 4.5 Give TWO reasons why an Ethernet LAN network uses frames, not packets.

1:
2:

(2)

- 4.6 Network devices perform various functions. Some devices can perform the same function as other devices. Complete the table below by placing a cross next to the appropriate device(s).

Device	Boosts the network signal	Converts between packets and frames	Can only read the MAC address	Reduces LAN traffic
Repeater				
Router				
Switch				
Bridge				

(6)

- 4.7 When networked devices communicate, many protocols are used to transmit the data. What would David be doing when the following protocols are used:

Protocol	David's Action
FTP	
HTTPS	
UDP	
DHCP	
IMAP	

(5)

QUESTION 5: SOCIAL IMPLICATIONS 12 MARKS

- 5.1 Learners are advised not to open emails sent to their school email address unless they know the email sender's identity.

- 5.1.1 Name and describe TWO possible threats to a learner or the school's network that could be caused by opening such emails.

1:
2:

(4)

- 5.2 David suggests starting a gaming club at the school.

- 5.2.1 List TWO potential injuries associated with excessive computer use.

1:
2:

(2)

- 5.2.2 Describe one way to avoid any ONE of the injuries you mentioned in Question 5.2.1.

(1)

5.3 The school principal wants to restrict access to any social media site such as Facebook, X(formally Twitter), Instagram and TikTok.

5.3.1 Do you think social media sites have any educational value?

Place a cross next to your chosen answer.

Yes

☐

No

☐

(1)

5.3.2 Give TWO reasons for your answer to Question 5.3.1.

1:
2:

(2)

5.3.3 Explain how learners at the school can bypass the blocked sites.

(2)

QUESTION 6:**SOLUTION DEVELOPMENT****51 MARKS**

The school has decided to store the **teachers** and **assistant teachers** in a database. An assistant teacher helps the teacher with setting and marking assessments. They will qualify to become a teacher after completing their final teaching examinations.

6.1 The details are stored for a teacher.

ID	Number	The identity number of the teacher
title	Short Text	The title of the individual
fullName	Short Text	The full name of the individual
dateOfBirth	Date	The date of birth of the individual
subject	Short Text	The current subject taught by the individual

You are required to create a class diagram to represent a Teacher object using the 5 fields in the Teacher Table. The fields must not be directly accessible from outside the class.

Include the following methods in the **Teacher** class diagram:

- A default constructor
- A parameterised constructor method, accepting the following parameters: **inId** (integer), **inT** (string), **inFN** (string), **inDob** (date) and **inS** (string).
- Accessor methods for the **fullName** **subject** and **date of birth** fields.
- A mutator method for the **subject** field. This method will have a parameter **sU**, of the correct type to match the field to be updated.
- A **toString()** method to concatenate the Teacher class fields.

Class Name: Teacher

(10)

6.2 David is confused with static and final fields. He thinks that all static fields must be final.

6.2.1 Explain why static fields are not the same as final fields.

(2)

6.2.2 Give an example of a possible static field in the **Teacher** class. Provide an appropriate name and explain the purpose of this field.

Static Field Name:
Explanation:

(2)

6.3 The school requires another class diagram for assistant teachers. Assistant teachers qualify to become a teacher after their last examination. Their final examination result is an additional field that must be stored for the AssistantTeacher class.

6.3.1 Draw a diagram showing the relationship between the Teacher and AssistantTeacher classes.

--

(3)

6.4 Define inheritance and composition.

Inheritance:
Composition:

(2)

6.4.1 Give ONE advantage of inheritance.

(1)

- 6.5 The following method algorithm called **getQualifiedTeacher** should return a string list of assistant teacher names qualified to teach a particular subject (e.g. Computer Applications Technology (CAT)). The subject name is sent as a string parameter to the method. To qualify, a teacher must achieve at least 70% in their examination.

An array, **tArray**, has been declared which contains both **Teacher** and **AssistantTeacher** objects and initialised as shown in the table below. Currently, there are only 3 teachers/assistant teachers in the array.

Assume that the accessor method **getExamResult** exists in the **AssistantTeacher** subclass.

tArray [0]	tArray [1]	tArray [2]
ID : 7834 title : Mr fullName: Shane dateOfBirth: 2001/05/22 subject: CAT examResult:55	ID :3434 title: Miss fullName : Shangase dateOfBirth: 2002/01/04 subject: CAT	ID :1235 title: Mr fullName: Jones dateOfBirth: 2002/05/06 subject:IT examResult :90

All assistant teachers need to be checked to see if they qualify. The following algorithm has been provided:

```

Method getQualifiedTeacher(s:string): string
begin
    temp ← ""
2.   for i ← 0 to 2 inc by 1
3.       if tArray[i] is of type AssistantTeacher
4.           AssistantTeacher a ← (AssistantTeacher) tArray[i]
5.               if (a.getExamResult() > 70 OR a.getSubject()=s)
6.                   temp ← temp + a.getFullName() + "\n"
               end if
           end if
       end for
7.   return temp
end method

```

Using the algorithm to complete the trace table in **Appendix A** using the above sample data:

(12)

6.5.1 Identify the line number for the error(s) in the trace table.

(1)

6.5.2 Correct line in Question 6.7.1.

(2)

6.6 Show how the details of the following teacher would be written in a JSON file:

ID :3241

title: Mr

fullName: Jasmin

dateOfBirth: 2000/12/25

subject: IT

--

(7)

- 6.7 The teachers have brainstormed a way of deciding whether they can appear as a guest at another school. They have formulated a rule to check whether they qualify for this opportunity.

T = Teacher, A = Assistant Teacher, P = Deputy Principal

Rule: The teacher is not teaching and the assistant teacher is available or the deputy principal can teach the subject.

The boolean function for this rule:

$$F(T,A,P) = (T'.A) + P$$

Complete the truth table for this function:

T	A	P					Result
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

(5)

6.7.1 Write the result as a boolean function:

F(T,A,P) =

(4)

[illegible]

Appendix A

tArray [0]	tArray [1]	tArray[2]
ID : 7834 title : Mr fullName: Shane dateOfBirth: 2001/05/22 subject: CAT examResult:55	ID :3434 title: Miss fullName : Shangase dateOfBirth: 2002/01/04 subject: CAT	ID :1235 title: Mr fullName: Jones dateOfBirth: 2002/05/06 subject:IT examResult :90

Assume that the parameter, s, has the value "CAT", and indicate only the id field value for variable 'a'

[illegible]