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TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
MAY 2024

INFORMATION TECHNOLOGY: PAPER II

EXAMINATION NUMBER

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 30 pages and an Answer Sheet of 2 pages (i–ii). Please check that your question paper is complete.
2. Read the questions carefully and make sure that you answer all parts of all the questions.
3. **Answer ALL the questions on the question paper and hand this in at the end of the examination. Remember to write your examination number in the space provided.**
4. Show all working details where applicable.
5. A non-programmable calculator may be used.
6. It is in your own interest to write legibly and to present your work neatly.
7. THREE blank pages (pages 28 to 30) 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 AND indicate within the original answering space that you answered in the extra space provided.

FOR MARKER'S USE ONLY

Question	1	2	3	4	5	6	7	**Total**
Marks	9	10	25	10	31	15	50	**150**
Marked								
Moderated								
Re-mark								

SECTION A SHORT QUESTIONS

QUESTION 1 DEFINITIONS

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

1.1 A type of high-speed RAM often used for cache memory.

_____

(1)

1.2 A bus interface which is used to connect mass storage devices to a motherboard.

_____

(1)

1.3 The stage of the machine cycle which is responsible for retrieving instructions from main memory.

_____

(1)

1.4 A design principle which allows individual components of a computer system to be easily changed and/or upgraded.

_____

(1)

1.5 The component of the CPU responsible for integer calculations.

_____

(1)

1.6 The physical arrangement or layout of nodes and connections on a network.

_____

(1)

1.7 A device used to connect two wireless LANs together.

_____

(1)

1.8 A protocol used by mail clients to retrieve email messages from a mail server using a TCP/IP connection.

_____

(1)

1.9 A compression technique which ensures no loss of data.

_____

(1)

9 marks

SECTION B SYSTEM TECHNOLOGIES

QUESTION 2 THEORY

For each of the terms in Column A below, select the **most correct** definition in Column C. Match the letter to the question number. Write down the appropriate letter in Column B. An example is shown as Question 2.0, using 'W' as the correct answer.

Column A	Column B	Column C
2.0	W	
2.1 Register		A The execution of more than one program simultaneously.
2.2 Graphic Processor		B A technique which allows a single piece of code to be processed by several processors at different stages of execution.
2.3 Hyper-threading		C The maximum amount of data which can be transmitted per unit of time.
2.4 Flash memory		D Small data storage locations within the CPU.
2.5 UEFI		E A form of electronic non-volatile storage.
2.6 Assembler		F A processor technology which allows multiple threads to run on each processor core.
2.7 Interrupt		G A piece of software which converts high-level language instructions into machine code.
2.8 Cloud storage		H A signal sent by a piece of software to stop the CPU's current processing.
2.9 Throughput		I A program which converts low-level language code into machine code.
2.10 Multitasking		J A form of storage which uses Internet-based services.
		K A type of memory which retains its contents briefly until it is changed.
		L A set of instructions which control the input and output operations of a PC.
		M The number of data items successfully sent per unit of time.
		N A specification for software which connects the firmware to the operating system.
		O Specialised electronic circuitry to accelerate image processing.

[10]

SCENARIO

Consider the following scenario when answering the rest of the examination paper, unless otherwise stated or the questions are of a general nature.

True Learn is a new school in your area. They have one building which has all the admin offices and classrooms. The school needs IT equipment and is asking for your assistance in selecting the most suitable equipment. Currently, the school does not have any Internet connectivity.

QUESTION 3 APPLICATION

True Learn is trying to decide between two devices. The specifications of these devices are shown below:

Device 1

HP Essential Core i3

10th gen Intel Core i3 processor 3,7 GHz
4 GB DDR4 RAM
512 GB storage
Intel UHD Integrated Graphics
USB Mouse and keyboard
Wi-Fi 5 & Bluetooth® 5,0
VGA, HDMI
4 USB 3,0 ports

Device 2

HP t740 Thin Client PC

AMD Ryzen Embedded processor 3,25 GHz
8 GB DDR4 RAM
32 GB storage
AMD Radeon Vega 8 graphics
USB Mouse and keyboard
2 × LAN ports 100/1000
VGA, HDMI
4 USB 3,0 ports

3.1 Device 2 is known as a 'thin client'.

3.1.1 What is meant by a *thin client*?

_____

_____

(1)

3.1.2 The processors in both devices are quad-core processors. What is meant by the term *quad-core*?

(1)

3.1.3 There has been a suggestion that the clock speeds of the processors are too low. One way to improve the clock speed is to use overclocking.

(a) Define *overclocking*.

(1)

(b) TRUE OR FALSE: The clock multiplier sets the ratio between the internal CPU clock rate and the system's external clock. Indicate your answer with a cross (X) in the appropriate block below.

True ☐ False ☐

(1)

(c) Explain the difference between per-component overclocking and system overclocking.

(2)

(d) Overclocking has some undesirable consequences. There is also a process known as 'underclocking' which slows down components. Give TWO reasons why a user might decide to underclock a device.

Reason 1:	
Reason 2:	

(2)

3.2 For the purposes of this question, assume that the school has chosen Device 2, the thin client.

Having multiple thin clients relies on large server resources. A general rule is to allow for 8 GB RAM on the server for each thin client that connects to it. There needs to also be sufficient RAM for the server's own needs.

3.2.1 The school has 5 admin workstations and 20 workstations for staff and students to use. Complete the table below to show how much RAM you would suggest the school installs on their server. You need not show the calculation; you may indicate only the final amount. Justify each of your answers with ONE reason.

Clients	Suggested server RAM	Justification
5 admin		
20 staff/student		
Server needs		
TOTAL		

(4)

3.2.2 Consider the total you calculated in Question 3.2.1 above. The largest individual RAM chip which the server is able to use is a 32 GB chip. Complete the table below to show how many chips will need to be installed on the server, and what the final total amount of RAM will be on the server.

Total RAM (from 3.2.1)	
Number of 32 GB chips	
Total installed RAM	

(3)

3.3 Assume for this question that Device 1 (HP Essential Core i3) has been chosen. Remember that the installed RAM of this device is 4 GB DDR4 RAM.

3.3.1 TRUE or FALSE: DDR RAM can transfer data twice as fast as SDRAM. Indicate your answer with a cross (X) in the appropriate box below.

True ☐ False ☐

(1)

3.3.2 What is the name given to the smallest part of the operating system that needs to be loaded into RAM at any one time?

_____

_____

(1)

3.3.3 If the installed RAM of 4GB is insufficient for loading the operating system as well as user data, the concept of virtual memory could be used.

(a) What is meant by virtual memory?

_____

_____

_____

_____

(2)

(b) Will the use of virtual memory in Device 1 have a performance implication for a computer from a speed perspective? Indicate your answer with a cross (X) in the appropriate box below. Justify your answer with ONE reason.

YES ☐ NO ☐

Justification: _____

_____

(2)

3.4 The software that each computer (Device 1 and Device 2) will need to have installed will have some similarities and some differences.

For each of the two software items below, i.e. the spreadsheet and browser, you need to:

- Indicate if the software item will be installed on the local storage of the device by answering Yes/No under the device name. If it will be installed on the local storage of both devices, you may simply answer Yes in the 'Both devices' column.
- Justify your choice by giving ONE reason for each.

Software Item	Device 1	Device 2	Both devices
Spreadsheet			
Justification			
Software Item	Device 1	Device 2	Both devices
Browser			
Justification			

(4)
[25]

35 marks

SECTION C INTERNET AND COMMUNICATION TECHNOLOGIES

QUESTION 4 THEORY

For questions 4.1 to 4.10, select **the most correct answer** from the options A–D. Write down the appropriate letter for your answer in the grid provided at the bottom of each page.

4.1 An audit trail …

A is used to find errors in a database.
B provides a record of changes and/or events.
C does not contain time- and date-stamped records.
D is created by employing an auditor.

4.2 IPV4 addresses …

A are stored in 128-bits.
B only consist of even numbers.
C are stored in 32-bits.
D never change for a particular device.

4.3 Digital currencies …

A are not linked to any normal currency.
B can be used to buy goods and services.
C are not issued by a country's central bank.
D All of the above.

4.4 Which of the following is not a component of Location Based Services (LBS)?

A A mobile device.
B An application.
C Positioning.
D Data loss.

4.5 Which of the following is a characteristic of Web 1.0 websites?

A Collaboration.
B Content browsing.
C Easy editing.
D Direct user-to-server communication.

Question	4.1	4.2	4.3	4.4	4.5
Answer					

4.6 The Onion Router (ToR) ….

A logs all user activity.
B creates a direct connection between your browser and a site being viewed.
C is open-source software.
D does not require any software to be downloaded.

4.7 Which of the following is not a characteristic of a cookie?

A Cookies are usually stored in small files.
B Cookies are always encrypted.
C Cookies are sent to a server each time a browser requests the page.
D Cookies are used to remember your online habits.

4.8 Video on demand …

A allows for viewing at any time.
B requires an Internet connection.
C allows for a wide range of content.
D All of the above.

4.9 The dark web …

A is illegal to browse.
B is a subset of the deep web.
C cannot be used to obtain counterfeit data.
D has content which is indexed by normal search engines.

4.10 Internet of Things (IoT) connected devices …

A collect data from various sources.
B only work indoors.
C do not use Wi-Fi connections.
D are unable to be used for facial recognition.

Question	4.6	4.7	4.8	4.9	4.10
Answer					

[10]

QUESTION 5 APPLICATION

In addition to the initial 25 devices originally mentioned, **True Learn** has built a new music centre which needs to become part of the network. The new building is 250 m away from the main building. Unless otherwise stated, or a question is of a general nature, assume that **True Learn** has decided to use Device 2 (the thin client) for all their network clients.

We need to consider the network configuration of the two device options from Question 3.

Device 1: Wi-Fi 5 & Bluetooth® 5,0

Device 2: 2 × LAN ports 100/1000

5.1 Device 2 has LAN ports which can operate at two different speeds indicated by the numbers 100/1000.

5.1.1 What unit would these two numbers (the speed of the port) be measured in?

_____

_____

(1)

5.1.2 Will it be advantageous for Device 2 to be able to operate at the higher speed? Indicate your answer by placing a cross (X) in the appropriate box below. Justify your answer with ONE reason.

YES ☐ NO ☐

Justification: _____

_____

(2)

5.2 Device 1 has Bluetooth® connectivity.

5.2.1 Give an example of TWO peripherals that might connect to this device via Bluetooth®. *(A peripheral is a device which is able to be attached to and used with a computer but is not a part of that computer.)*

Peripheral 1:	
Peripheral 2:	

(2)

5.2.2 Using the **same** two peripherals you mentioned in Question 5.2.1 above, suggest how these devices would be able to connect to Device 2, which does not have Bluetooth®. Your answers may not be the same as each other.

Peripheral 1 connection to Device 2:	
Peripheral 2 connection to Device 2:	

(2)

5.3 **True Learn** needs to connect the new music centre to the main building so that any computers in the new building are able to connect to the network. There are two possible cables (UTP and fibre) which could be used for this task.

5.3.1 Which of these cables would you recommend using for the connection between the two buildings? You may not assume there is any other hardware between the two points on the network. Place a cross (X) in the appropriate box to indicate your answer. Justify your answer with TWO reasons.

Fibre ☐ UTP ☐

Reason 1: _____

_____

Reason 2: _____

_____

(3)

5.3.2 A parent at the school has suggested that a cabled solution is not the most cost effective and that the school should connect the new building and the main building wirelessly.

(a) Name ONE additional piece of hardware which will be needed to connect the buildings wirelessly.

(1)

(b) How many of the hardware item named in (a) above will be needed? Justify your answer with ONE reason.

Number:

Reason:

(2)

(c) How would this piece of hardware connect to the network?

(1)

5.4 **True Learn** needs to ensure that data on their network is secure. Assume that the **True Learn** server has a total of 2 TB of data.

5.4.1 Give TWO reasons why **True Learn** need to back up their data.

Reason 1:

Reason 2:

(2)

5.4.2 Currently, there is an external drive connected to the server, which is used for data backup. Give TWO reasons why this is not considered to be good practice.

Reason 1: _____

_____

Reason 2: _____

_____

(2)

5.4.3 **True Learn** needs information on TWO other options to back up their data, which would be in line with good practice. List these options in the column provided for Option 1 and Option 2 AND explain why these techniques would be better than the technique in Question 5.4.2 above.

Option 1:	Explanation
Option 2:	Explanation

(4)

5.4.4 The **True Learn** server has the school admin system stored on it. The admin system has all the student, staff and parent data in a database. Suggest how often this data should be backed up. Justify your answer with ONE reason.

Frequency of backup:
Justification:

(2)

5.4.5 In addition to a backup solution, **True Learn** should also implement RAID on their server for complete data protection.

(a) TRUE or FALSE: RAID requires a special controller in addition to the normal drive controller.

_____

(1)

(b) How does RAID minimise data loss?

_____

_____

(1)

(c) Different RAID levels are implemented by using either **mirroring** or **striping** to store data. Complete the table below for RAID 1 and RAID 5 by indicating which implementation relates to which RAID level.

RAID level	Implementation
RAID 1	
RAID 5	

(2)

(d) **True Learn** has implemented a RAID 5 solution. After a few months, multiple drives in the RAID 5 array fail at the same time and the data cannot be rebuilt. How will **True Learn** be able to get their data back?

(1)

5.4.6 There are two types of backups: a full backup, where all data is backed up from one drive to another; and an incremental backup, where only the files which have changed since the last full backup are backed up from one drive to another.

Give TWO reasons why it is preferable to do incremental backups rather than full backups.

Reason 1:

Reason 2:

(2)
[31]

41 marks

SECTION D SOCIAL IMPLICATIONS

QUESTION 6

6.1 Social engineering is defined as: *'the use of deception to manipulate individuals into divulging confidential or personal information that may be used for fraudulent purposes.' (Oxford Languages, via Google search)*

There are a number of social engineering techniques. The table below lists THREE techniques. You are required to:

- describe how the technique is used AND
- explain how **True Learn** can prevent these techniques from being used in their school, particularly to protect their staff.

Shoulder surfing	How used:
	Prevention:
Dumpster diving	How used:
	Prevention:
Phishing	How used:
	Prevention:

(6)

6.2 **True Learn** is worried that some of their students are being subjected to cyberbullying via social media.

6.2.1 Define *cyberbullying*.

_____

_____

(2)

6.2.2 Give TWO examples of social media platforms that can be used for cyberbullying.

Platform 1: _____

Platform 2: _____

(2)

6.2.3 Suggest TWO ways in which **True Learn** can support students who have been subjected to cyberbullying.

Support 1: _____

_____

Support 2: _____

_____

(2)

6.2.4 Give ONE reason why cyberbullying can be more difficult to detect than physical bullying.

_____

_____

(1)

6.3 **True Learn** encourages students to make use of the Internet when doing research.

Name and explain ONE technique that can be used to evaluate any data source, especially a website, to ensure that the content is reliable.

Name: _____

Explanation: _____

_____

_____

(2)

15 marks

SECTION E DATA AND INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT

QUESTION 7

7.1 One of the programs used at **True Learn** is used to store and work with details of food ordered daily at the school tuckshop. The program makes use of objects to hold relevant information and is made up of several classes. Students and teachers may order food from the tuckshop. Students and teachers can order snacks and drinks at lunchtime, and teachers can also order a takeaway meal to take home in the evening.

The Order Class

This class will be used to instantiate an **Order** object. An **Order** object will have the following fields:

name : string
snack : integer //the number of snack items ordered
drink : integer //the number of drink items ordered
totalCost : real

SNACKCOST = 5,50
DRINKCOST = 10,00

The **name** field should only be accessible from inside the **Order** Class, the **snack, drink** and **totalCost** fields should also be accessible from any class which inherits from the **Order** class. The fields **SNACKCOST** and **DRINKCOST** can be accessible from any class.

The **Order** Class will have the following methods:

- Parameterised constructor method accepting the following parameters: **n** (string), **s** (integer), **d** (integer);
- Accessor methods for the **snack** and **drink** fields;
- Mutator method for the name field which will accept a parameter **n** of type string;
- A typed method named **calculateCost()** which will determine the total cost of an **Order** and return this value. The total cost will be calculated by multiplying the number of snacks and drinks ordered by their respective costs and adding these values together;
- A **toString()** method that will concatenate the fields of an **Order** object into a single string object.

The TeacherOrder Class

This class will be used to instantiate **TeacherOrder** objects for each teacher who orders food from the tuckshop. This class inherits from the **Order** class. A **TeacherOrder** object will have the following additional fields and types:

takeAwayMeal : integer //the number of takeaway meals ordered

TAKEAWAYCOST = 30,00

The **takeAwayMeal** field should only be accessible from inside the **TeacherOrder** class, but the **TAKEAWAYCOST** field can be accessed from any class.

The **TeacherOrder** Class will have the following methods:

- Parameterised constructor method that accepts the parameter **tAM** (integer) in addition to the parameters of the parent class;
- Accessor method for the **takeAwayMeal** field;
- A typed method named **calculateCost()** which will determine the total cost of a **TeacherOrder** and return this value. This will be the same calculation as for an **Order** object but will also have the cost of a takeaway meal added by multiplying the number of takeaway meals by the cost of the takeaway meal;
- A **toString()** method that will concatenate the fields of the child object with the fields of the parent object into a single string object.

7.1.1 Class diagrams are used in the design phase of programming. Give TWO reasons why they are an important part of this phase.

Reason 1: _____

_____

Reason 2: _____

_____

(2)

7.1.2 Complete the class diagrams for the **Order** and **TeacherOrder** classes on the Answer Sheet on page (ii). Indicate the relationship (if any) between the classes. Show the declaration of all the fields and methods outlined in Question 7.1 on pages 19 and 20.

(8)

7.1.3 In both these classes, there are fields whose names are shown in capital letters and are underlined.

(a) Write down TWO characteristics of these fields which explain why they are written in this way.

Characteristic 1	
Characteristic 2	

(2)

(b) Give ONE reason why it is permissible for fields declared in this way to be accessible from other classes.

(1)

(c) Give ONE reason why it is not a good idea to use this type of field for a value such as the price of a food or drink item.

(1)

(d) Both classes have a typed method named ***calculateCost()*** which is used to work out the cost of an **Order** or a **TeacherOrder**.

(i) Explain the difference between a typed method and a void method by explaining what each does.

(2)

(ii) In the **Order** class, the following line of code has been written in the **calculateCost** method.

```
(snack * SNACKCOST) + (drink * DRINKCOST)
```

The result of this line is assigned to a real variable.

In the **TeacherOrder** class, the following line of code has been written in the **calculateCost** method.

```
(snack * SNACKCOST) + (drink * DRINKCOST) +
(takeAwayMeal * TAKEAWAYCOST)
```

The result of this line is assigned to a real variable.

Give ONE way in which the code in the **TeacherOrder** class could be simplified.

_____

_____

_____

_____

(2)

7.1.4 An additional class, the **OrderArray** class has been coded which will allow both **Order** objects and **TeacherOrder** objects to be stored in an array for processing.

(a) Will the array of objects need to be declared as an **Order** or **TeacherOrder** object?

_____

(1)

(b) Justify your answer to Question 7.1.4 (a) above.

_____

_____

_____

_____

(2)

(c) Assume that the array has been given the name **oArr** and that there is an integer variable **size** which keeps track of the number of objects in the array. Complete the following line of Java/Delphi code (depending on the language you have studied) to show how you will be able to determine if an object at a particular position in the array is a **TeacherOrder** object. In each case, you need to write TWO words.

Java: if (oArr[size] _____ _____)

Delphi: if oArr[size] _____ _____ then

(2)

7.1.5 Both the **Order** class and the **TeacherOrder** class have constructor methods. Two IT students are arguing about these methods: student #1 says this is an example of method overloading, and student #2 says it is method overriding.

State which student is correct or if neither is correct. Clearly explain the concepts of overloading and overriding as part of your answer.

(3)

7.2 Consider the following algorithm for a method, calculateSales, to calculate the total number of snacks and drinks sold at the tuckshop. The method will return the total number of items sold (drinks and snacks) together with a message showing which item had the highest number sold.

Also consider the following portion of the array **oArr**:

Element	oArr[0]	oArr [1]	oArr [2]	oArr [3]	oArr [4]
Name	Jolly Dolly	Sean Mkhize	Queen Mzobe	Jimmy Jones	Raheel Naidoo
Snack	1	1	2	2	3
Drink	3	1	1	2	2
TotalCost	25,50	75,50	21,00	61,00	26,5
TakeAwayMeal		2		1	

The method, **calculateSales**, which is a typed method, will receive a parameter indicating the number of elements in the array. There are FIVE (5) elements in this array. This value will be assigned to the variable **num which is passed through to the method**.

Other variables are defined for specific use in the method. For the purposes of this question, you may assume that the data shown above is the only data in the array.

```
method calculateSales (num : integer)
1  count ← num
2  total ← 0
3  countS ← 0
4  countD ← 0
5 temp ← ""

6  for k ← 0 to count – 1,   inc by 1
   begin
7    countS ← countS + oArr[k].getSnack()
8    countD ← countD + oArr[k].getDrink()
9    total ← countS + countD
    end for
10  if countS > countD
      begin
11     temp  ← temp + "More snacks than drinks sold"
12        else temp  ← temp + "More drinks than snacks sold"
      end if
13   temp  ← temp + newline + "Total sold " + total
14   return temp
```

7.2.1 The above algorithm has been coded, but it does not produce the correct results. Complete the following trace table to show what the algorithm is doing. You must include the line numbers as a reference to the line of code in the algorithm. Note: there are more lines on the grid than are necessary for a correct answer.

Line	count	total	countS	countD	temp	k	countS > countD ?	Return

(10)

7.2.2 When checking the output of the algorithm against the data shown above, there is an obvious problem with the logic in the algorithm.

(a) What is the correct number of snacks and drinks sold from the given data in the table provided in Question 7.2?

Total snacks: _____

Total drinks: _____

(1)

(b) Explain how the algorithm needs to be altered to ensure that it produces the expected output.

_____

_____

_____

_____

_____

(2)

(c) The type has been omitted from the method header. What type will this method be declared as?

_____

_____

(1)

7.3 **True Learn** is interested in working out further information about students and teachers who order food from the tuckshop to offer a discount to certain buyers.

True Learn management wishes to consider the following criteria:

- More than 20 snacks bought in a month – let this equal S.
- More than 40 drinks bought in a month – let this equal D.
- More than 5 takeaway meals bought in a month – let this equal T.

The following Boolean function has been chosen to determine if a buyer is eligible for a discount:

((S AND D) OR (D AND T)) OR (S AND T OR D)

This function can be represented as: ((S.D) + (D.T)) + (S.T + D)

Complete the truth table on the following page to represent the condition shown above.

S	D	T	(S.D)	(D.T)	(S.D) + (D.T)	(S.T)	(S.T)+D	((S.D) + (D.T)) + (S.T+D)	RESULT True/False
0	0	0							
0	0	1							
0	1	0							
0	1	1							
1	0	0							
1	0	1							
1	1	0							
1	1	1							

(10)

50 marks

Total: 150 marks

ADDITIONAL SPACE (ALL QUESTIONS)

REMEMBER TO CLEARLY INDICATE AT THE QUESTION THAT YOU USED THE ADDITIONAL SPACE TO ENSURE THAT ALL ANSWERS ARE MARKED AND THAT YOU REFLECT THE CORRECT QUESTION NUMBER HERE.

