TOTAL MARKS

NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020

INFORMATION TECHNOLOGY: PAPER I

EXAMINATION NUMBER

Time: 3 hours 180 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 36 pages and an Appendix 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 each question.

3. Answer on the question paper. Please make sure that you write your examination number in the blocks above.

4. Answer ALL questions – there are no options in this paper.

5. Show all working where applicable.

6. A non-programmable calculator may be used.

7. It is in your own interest to write legibly and to present your work neatly.

8. Four blank pages (pages 33 to 36) are included at the end of the paper. If you run out of space for a question, use these pages. Clearly indicate the question number of your answer should you use this extra space.

FOR MARKER'S USE ONLY

Question	1	2	3	4	5	6	7	8	9	Total
Marks	10	10	10	35	20	22	15	34	24	**180**
Marked										
Moderated										

SECTION A   SHORT QUESTIONS

QUESTION 1   DEFINITIONS

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

1.1   A design principle where computers are built with easily replaceable parts.

_____
(1)

1.2   An attempt to obtain sensitive information from a user via email, under the disguise of a trustworthy organisation or entity.

_____
(1)

1.3   The generic term for a system where users can choose filmed entertainment from a wide selection and watch it when it suits them.

_____
(1)

1.4   A connectionless transmission protocol with no guarantee of ordering or delivery.

_____
(1)

1.5   A network of "robots" used to commit cybercrimes.

_____
(1)

1.6   A mobile computing device, larger than a smartphone, but which offers facilities such as a touch screen and a rechargeable battery in a small form factor.

_____
(1)

1.7   A networking device which connects two dissimilar networks, using different protocols.

_____
(1)

1.8   A means of accessing a network that bypasses the normal security measures.

_____
(1)

1.9   A network topology that allows nodes to connect to any one of many wireless points that each acts as a router.

_____
(1)

1.10   Platforms that allow users to interact, share information and media or ideas, with facilities to like, comment and re-share other posts in virtual communities and networks.

_____
(1)
[10]

QUESTION 2   MATCHING COLUMNS

For each of the terms in Column A below, you should select the **most correct** definition in Column C, matching the letter to the question number. You should merely 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	SATA		A	Presenting large amounts of data that may leave the user confused and unable to make decisions
2.2	Plug and play		B	A protocol that allows the universal transfer of data
2.3	Social engineering		C	A form of browser attack where traffic is redirected to a fake website
2.4	WiMAX		D	A computer bus technology commonly used to connect hard drives
2.5	UTP		E	A connection standard for computers and peripherals that allows for serial data and power transfer
2.6	Pharming		F	A form of illegal file transfer
2.7	USB		G	The process whereby an operating system automatically recognises a device when installed and used for the first time
2.8	Firmware		H	A technique used to steal and redirect traffic to an alternative website in search engine results
2.9	Information overload		I	A wireless standard similar to Wi-Fi, which supports a far greater range of coverage
2.10	BitTorrent		J	Permanent software programmed into a ROM chip
			K	The ability to add or remove devices without powering down the system
			L	The manipulation of people to divulge confidential information
			M	A wireless network standard that uses multiple high-speed cellular phones to provide connectivity
			N	A group of hard-wired devices
			O	A commonly used cable that consists of a number of intertwined pairs of cables
			P	A file transfer mechanism where small parts of a file are received from or sent to different networked clients

[10]

20 marks

SECTION B   SYSTEM TECHNOLOGIES

QUESTION 3   THEORY

For each of the questions below, you need to select **the most correct answer** from the options A–D. There is an answer grid at the bottom of each of the next two pages, each for five questions. You merely need to write down the appropriate letter for your answer.

3.1   Hot swapping allows a user to:

     A   re-boot his desktop without losing any data or backup
     B   add a device without needing to load drivers or interrupt tables
     C   insert/remove devices without powering down the device
     D   none of the above

3.2   The battery life of a laptop is affected by:

     A   screen brightness
     B   processor speed
     C   number of active processes
     D   all of the above

3.3   Which of the following is an advantage of computer mobility?

     A   less need for office space
     B   no servers are required
     C   a smarter workforce
     D   computers are less vulnerable to viruses

3.4   A Quad Core processor with hyperthreading has:

     A   4 physical processing cores and shared L1 cache
     B   8 physical processing cores and 4 logical processors
     C   4 virtual processing cores and shared L1 cache
     D   4 physical processing cores and 8 logical processors

3.5   A software interrupt:

     A   can also be issued by hardware devices
     B   is sent by the software application to the CPU
     C   will always result in a runtime error
     D   will appear in an interrupt table

Question	3.1	3.2	3.3	3.4	3.5
Answer					

3.6   The speed of a network card:

      A   has no effect on the overall performance of a PC
      B   can be improved by an operating system update
      C   can vary depending on what device it connects to
      D   none of the above

3.7   Which of the following is a disadvantage of using Software as a Service (SaaS)?

      A   easy upgradability
      B   security of data
      C   lower up-front costs
      D   quick deployment

3.8   Recommended computer management tasks do not include:

      A   changing the screen resolution
      B   drive defragmentation
      C   backup and restoration testing
      D   antivirus updates

3.9   The Front Side Bus (FSB) connects:

      A   the CPU and the Northbridge
      B   the Northbridge and the Southbridge
      C   the Southbridge and the CPU
      D   the Southbridge and the RAM slots

3.10   Graphics cards often have dedicated RAM and processors:

      A   because a graphics card's RAM is made from SRAM
      B   because the CPU has limited cache
      C   to reduce the load on the system RAM and CPU
      D   because normal system RAM is volatile

Question	3.6	3.7	3.8	3.9	3.10
Answer					

[10]

SCENARIO

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

Pizza World is a chain of pizza stores in a city. They have 25 different outlets in the city. Some outlets cater for walk-in customers, but all offer a delivery service. **Pizza World** do not employ any staff to deliver their pizzas – they use part-time delivery agents.

When someone orders a pizza from a **Pizza World** outlet, the order is shown on their mobile application. Anyone who is employed as a part-time delivery agent can see the order on the application and can accept the order. He or she must then drive to the outlet, collect the pizza(s) and deliver it to the customer. Obviously, it makes sense for the agents to accept orders from the outlet closest to where they are currently located.

QUESTION 4   APPLICATION

Two new delivery agents, Hermione and Thabo are looking at buying a suitable mobile device to enable them to work for **Pizza World**. They have seen the following two devices advertised:

DEVICE A
7 inch display (1024 × 600)
Android N (Nougat)
Camera Rear: 2 MP; Front: 2 MP
RAM: 1 GB; ROM:16 GB
Micro SD slot (up to 256 GB)
Bluetooth; Wi-Fi; GPS
Monthly data plan 5 GB included
Battery use: 7 hours normal usage

DEVICE B
6,5 inch display (1792 × 828)
iOS 13
Camera Rear: 12 MP; Front: 12 MP
RAM: 512 GB
GSM
Bluetooth; Wi-Fi; GPS
Monthly data plan 5 GB included
Battery use: 11,5 hours normal use

MP = megapixel (10^6 pixels)

Thabo decided to buy Device B and Hermione purchased Device A.

4.1 These devices make use of RAM and ROM. Define each of these terms. It is insufficient to merely expand the acronyms.

RAM: _____

_____

ROM: _____

_____

(2)

4.2 Device A has 1 GB of RAM and 16 GB of ROM. Give an example of the expected data that will be stored in each.

RAM: _____

_____

ROM: _____

_____

(2)

4.3 Device A supports Micro SD cards.

4.3.1 Are SD cards a type of RAM or ROM storage?

_____

(1)

4.3.2 Justify your answer with TWO reasons.

Reason 1: _____

_____

(1)

Reason 2: _____

_____

(1)

4.3.3 Give TWO examples of the data Hermione might store on the SD card.

Example 1: _____

_____

(1)

Example 2: _____

_____

(1)

4.4   Device B has a higher resolution display than Device A.

    4.4.1 Screen resolution is measured in pixels. What is meant by the word *pixel*?

        _____

        _____

(1)

    4.4.2 Name ONE factor that will affect the resolution of a display.

        _____

        _____

(1)

4.4.3   A useful technique to compare the resolutions of two devices is to calculate the pixels per inch (PPI) of the display. This helps when comparing two devices with different screen sizes and resolutions, which can be confusing.

The PPI of a display is calculated by using the following variable assignments and mathematical formula:

Input values for R1, R2 and S.

(R1 = horizontal resolution, R2 = vertical resolution, S = screen size)

$$PPI = \frac{\sqrt{(R1^2 + R2^2)}}{S}$$

(a)   Using the variable assignments and formula above, write out an algorithm for calculating the PPI of any display. Use R1, R2 and S as variables for the two resolution values and size respectively, and the variable PPI for the final answer. The values for R1, R2 and S may either be assigned or entered via an input statement. You may include any other variables you might need.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____
(6)

(b)   We wish to calculate the PPI of Device A. (7 inch display, 1024*600 resolution) Look at the grid below, which has a series of letters A–K that each corresponds to a calculation step. You need to pick the individual letters that will correctly calculate the PPI of Device A, and enter **the correct letters** into the formula shown at the end of the grid.

A	1792^2
B	$\sqrt{(1024^2 + 600^2}$
C	1024^2
D	7^2
E	$\sqrt{1024}$
F	7
G	600^2
H	$\sqrt{1792 + 800}$
I	512^2
J	$\sqrt{600}$
K	828^2

$$PPI = \frac{\sqrt{(\underline{\hspace{1cm}} + \underline{\hspace{1cm}})}}{\underline{\hspace{1.5cm}}}$$

(4)

4.5   Each device has two cameras. The resolutions of the cameras are very different.

      4.5.1   Would the resolution of the camera play an important role in the decision to purchase Device A rather than Device B, given the intended purpose of the device in this scenario?

                (1)

      4.5.2   Justify your answer with two reasons.

          Reason 1:

                (1)

          Reason 2:

                (1)

4.6   Provide TWO reasons why battery life will be an important factor when choosing a device, given the intended purpose of the device in this scenario.

Reason 1:

                (1)

Reason 2:

                (1)

4.7   The devices use different operating systems. Compare the two operating systems using the table below by placing a tick (✓) in the appropriate space:

Characteristic	Android	iOS
Open-source		
Proprietary		
Free with device		

                (4)

4.8   The owners of **Pizza World** had to create two versions of their mobile app to be used on devices such as Device A and Device B. Give ONE reason why this was necessary.

_____

_____

(1)

4.9   A further storage option with either device might be cloud storage.

    4.9.1   What is meant by the term *cloud storage*?

    _____

    _____

(1)

    4.9.2   What THREE essential requirements (regardless of the device they have chosen) are needed for Hermione and Thabo to be able to use cloud storage while they are fetching and delivering pizzas?

        Requirement 1:   _____

        _____

(1)

        Requirement 2:   _____

        _____

(1)

        Requirement 3:   _____

        _____

(1)
[35]

45 marks

SECTION C　　　INTERNET AND COMMUNICATION TECHNOLOGIES

QUESTION 5　　　THEORY

In the Appendix (page i) is a diagram labelled Appendix A. It shows a typical network layout for a branch of **Pizza World**. Study this diagram before answering Question 5 and Question 6. The server at each outlet is used to record transactions from walk-in customers at that outlet. It is also used to keep track of the pizza ingredients used at the branch.

Remember to also keep the overall scenario in mind.

5.1　The diagram shows a device connecting the various nodes into a single network. This device is called a hub. These devices are not generally used on modern networks.

　　5.1.1　What is the name of the device that has replaced hubs in a network?

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(1)

　　5.1.2　Name ONE similarity between a hub and the device you named in Question 5.1.1.

　　　　　Similarity:

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(1)

　　5.1.3　Explain why the newer component is **more efficient** than a hub. A hub receives signals from one node and duplicates that signal to all other nodes on the network. You need to include TWO factors in your answer when comparing the two devices.

　　　　　Factor 1:

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(1)

　　　　　Factor 2:

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(1)

5.2   The printer is connected as a network device.

   5.2.1 List ONE advantage of having the printer as a node on the network.

   _____

   _____
                                                                                           (1)

   5.2.2 The printer has been allocated the following IP address on the network:

   10.10.58.101

   (a)   Is this an example of an IPv4 or IPv6 address?

   _____
                                                                                           (1)

   (b)   List ONE similarity and ONE difference between IPv4 and IPv6 addresses.

   Similarity: _____

   _____
                                                                                           (1)

   Difference: _____

   _____
                                                                                           (1)

   (c)   Explain why IPv6 addresses were introduced.

   _____

   _____

   _____

   _____

   _____

   _____
                                                                                           (2)

5.2.3   Assume the port on the hub to which the printer connects fails and there are no other spare ports available on the hub.

Explain ONE way, other than connecting to the hub, in which the printer could be connected so that all the point of sale devices on the network would still be able to print to it. Your answer must include an explanation of why the devices will be able to print across the network.

_____

_____

_____

_____

_____

(2)

5.3   A wireless access point (WAP) is shown as part of the network.

5.3.1   What is the function of a wireless access point?

_____

_____

(1)

5.3.2   If a device connects to the WAP, will it need an IP address?

_____

(1)

5.3.3   Explain your answer to Question 5.3.2 above.

_____

_____

_____

_____

(2)

5.4   Data which is stored on any server or PC needs to be secured. Two techniques which are often used are backups and RAID.

Explain how these two processes are different and why RAID is not considered a form of backup.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)
[20]

QUESTION 6   APPLICATION

6.1   Walk-in customers can make use of the wireless access points (WAPs) in a **Pizza World** branch while they wait for their orders. The service is offered free to customers. Customers who wish to make use of the service, need to request a Wi-Fi voucher from a cashier. The voucher contains a username and password.

6.1.1   Give TWO reasons why **Pizza World** use vouchers for Wi-Fi access rather than providing free and open Wi-Fi access.

Reason 1: _____

_____
(1)

Reason 2: _____

_____
(1)

6.1.2   A customer who used the free Wi-Fi believed that because he needed a username and password, this meant that the wireless traffic would be secured and encrypted.

(a)   What is meant by the word *secured*?

_____

_____
(1)

(b)   Name ONE protocol that can ensure encrypted wireless data transmission.

_____
(1)

(c)   Would the customer still be at any risk if they logged onto the Wi-Fi with a username and password, using the protocol you chose in Question 6.1.2 (b).

_____

_____

_____

_____

_____
(2)

(d)   If the customer's banking details were stolen while using **Pizza World's** free Wi-Fi, would **Pizza World** be liable for any losses the customer might suffer?

(1)

(e)   Justify your answer to part (d) with TWO reasons.

Reason 1:

(1)

Reason 2:

(1)

(f)   State TWO methods **Pizza World** could use to limit their potential liability in any scenario similar to this.

Method 1:

(1)

Method 2:

(1)

6.2   Hermione and Thabo are very busy working as delivery agents for **Pizza World**. Remember, Hermione has purchased Device A, and Thabo has purchased Device B.

6.2.1   Device B (which Thabo uses) has GSM as a feature. Using the table shown below,

(a)   list THREE common uses of GSM; and

(b)   explain how Hermione would still be able to use her device for these uses even though it does not have GSM.

Use Column A to write down your answers for part (a) and Column B your answers for part (b).

Column A (common uses of GSM)	Column B (how Hermione will compensate)

(6)

6.2.2 Both devices have GPS as a feature.

(a) What is GPS? (It is insufficient to merely expand the abbreviation.)

_____

_____
(1)

(b) Other than the application provided by **Pizza World**, name ONE other application that Hermione and Thabo will probably use in conjunction with GPS in their delivery work.

_____
(1)

6.3 The owners of a **Pizza World** outlet wish to work with other businesses to help advertise one another's products. **Pizza World** wants to do this via their website, and a mobile application they are developing for the public to use to order pizzas.

6.3.1 What service will be used to show adverts for other businesses that are close to any one **Pizza World** outlet?

_____
(1)

6.3.2 Suggest to the owners ONE type of business whose advertising would complement **Pizza World** and ONE type of business whose advertising would compete with **Pizza World**.

Complement: _____

_____
(1)

Compete: _____

_____
(1)

[22]

42 marks

SECTION D   SOCIAL IMPLICATIONS

QUESTION 7

Read the following extract from an article dealing with medical matters and answer the questions that follow.

Facebook and YouTube moderators sign PTSD* disclosure

Content moderators* are being asked to sign forms stating they understand the job could cause post-traumatic stress disorder (PTSD), according to reports.

It is reported that moderators for Facebook and YouTube, hired by the contractor Accenture, were sent the documents, which required them to acknowledge the mental health risks of the role.

Moderators monitor objectionable materials and often view hundreds of disturbing images in a day's work.

Accenture said the wellbeing of workers was a "top priority".

In a statement the company added that only new joiners were being asked to sign the forms, whereas existing employees were being sent the form as an update.

"We regularly update the information we give our people to ensure that they have a clear understanding of the work they do," Accenture said in a statement.

Facebook and Google (who own YouTube) said they did not review Accenture's new form, but they do require their partners to offer psychological support for content moderators.

The forms sent to the moderators outline support services on offer, including a hotline and a wellness coach. But it concedes in the forms that neither one is staffed by medical professionals and that they "cannot diagnose or treat mental disorders".

[Adapted from: <https://www.bbc.com/news/technology-51245616> (Accessed 25 January 2020)]

***Post-traumatic stress disorder (PTSD)** is a mental health condition that is triggered by a terrifying event – either experiencing it or witnessing it. Symptoms may include flashbacks, nightmares, and severe anxiety, as well as uncontrollable thoughts about the event.

***Content moderators** determine whether content, for example a post or a comment on social media, is within the guidelines of the platform.

7.1   Give TWO reasons why social media sites "moderate" the content that is published.

Reason 1: _____

_____

(1)

Reason 2: _____

_____

(1)

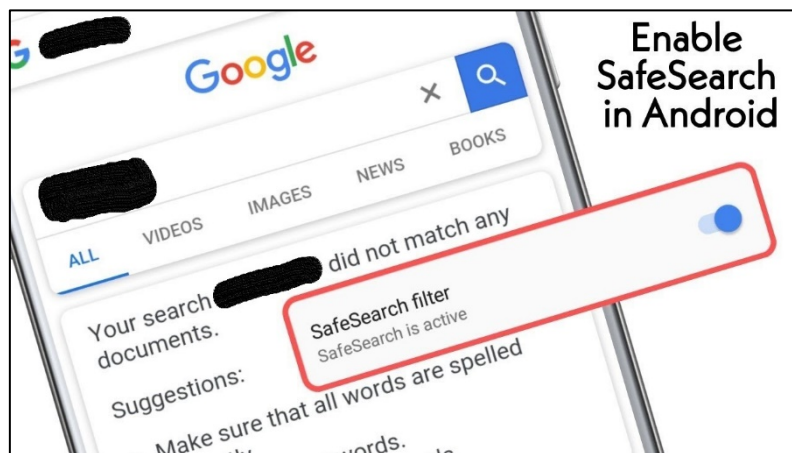7.2   Give TWO examples of content that might appear on Facebook or YouTube that would be considered undesirable.

Example 1: _____

_____
(1)

Example 2: _____

_____
(1)

7.3   Google offers an option called "Safe search". The image below shows this option being used in a search on an Android mobile device.

Explain why this option alone is insufficient in preventing undesirable content from being viewed online.

_____

_____
(1)

7.4   Explain, with TWO reasons, why employers of the content moderators would want content moderators to sign these documents. You may not use any of the reasons given in the article.

Reason 1: _____

_____
(1)

Reason 2: _____

_____
(1)

7.5   If you were a content moderator employed by Accenture, would you be happy that the staff employed to help content moderators are not able to diagnose or treat mental disorders? Justify your answer.

_____

_____

_____

_____

(2)

7.6   One response to this article suggested that the problems content moderators face could be reduced if *smart algorithms* were used to undertake automated moderation.

Evaluate how successful you believe this approach will be by referring to:

- efficiency (speed) of moderation; and
- effectiveness of moderation

Give TWO reasons for efficiency and TWO reasons for effectiveness.

Efficiency	Effectiveness

(4)

7.7   The owners of **Pizza World** are worried that if their app is hacked, inappropriate content might appear on their app. How can they best prevent such content from being uploaded to their app?

_____

_____

_____

_____

(2)

15 marks

SECTION E   DATA AND INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT

QUESTION 8

Pizza World uses a database to keep track of deliveries. It has only one table, which holds all the records of pizzas that have been delivered.

The **Orders** table has the following fields:

Field	Description
OrderID	Unique number for each order
CustName	The name of the customer who ordered the pizza
PizzaType	The type of pizza that was ordered
AgentName	The name of the delivery agent who delivered the pizza
AgentPhone	The phone number of the delivery agent
OnTime	A field to indicate whether the order was delivered on time or not

OrderID and **AgentName** have been selected as the primary key.

An extract from the table is shown below:

Orders

OrderID	CustName	PizzaType	AgentName	AgentPhone	OnTime
23	John Biggs	Three Cheese	Hermione	0787786619	Yes
25	Honorato Stark	Neapolitan	Thabo	0778412251	Yes
36	Uriel Todd	Chicken Pesto	Jimmy	0685524114	No
38	Cullen Higgins	Bianca	Hermione	0787786619	Yes
40	Chaim Miranda	Prosciutto	Fazul	0836591147	Yes
45	John Biggs	Funghi	Jia-Haui	0825421145	No
48	Honorato Stark	Supreme	Thabo	0778412251	No
50	Zane Kim	Three Cheese	Hermione	0787786619	Yes
52	Travis Levine	Chicken Pesto	Thabo	0778412251	Yes
55	Uriel Todd	Neapolitan	Hermione	0787786619	Yes
58	Abbot Lloyd	Three Cheese	Jia-Haui	0825421145	No

8.1   It has been discovered that the data in the **OnTime** field is incorrect. All items that are currently shown as "Yes" should be "No" and *vice versa*. The database administrator has written the following two SQL commands in an attempt to change the field's values:

- UPDATE Orders SET OnTime = "Yes" WHERE OnTime = No;
- UPDATE Orders SET OnTime = "No" WHERE OnTime = Yes;

8.1.1   After running the first of the two commands, she realises that there is a problem with the data in the **OnTime** field. Explain what has happened.

_____

_____

_____

_____

(2)

8.1.2   Will running the second query help fix the problem?

_____

(1)

8.1.3   The administrator needs to recover from the problem that has occurred. Suggest TWO methods provided by the DBMS that could be used to return the data in the OnTime field to what it was before the SQL statement was executed. *Your two methods may not use any SQL statements.*

Method 1:   _____

_____

(1)

Method 2:   _____

_____

(1)

8.1.4   The administrator still needs to change the incorrect data, i.e. swap the yes/no values in the OnTime field. Describe TWO ways in which SQL statements could be used to correct this error.

Method 1:   _____

_____

_____

(1)

Method 2:   _____

_____

_____

(1)

8.2   A new order is received for a Three Cheese Pizza to be delivered to Travis Levine. The order has not been accepted or collected by a delivery agent via the app. The order has been assigned an OrderID of 66. This record cannot be added to the orders table.

8.2.1   What type of anomaly is this an example of? Indicate your answer by placing a tick in the appropriate box below:

UPDATE	
DELETE	
INSERT	

(1)

8.2.2 Explain WHY it is not possible for this order to be added to the orders table.

_____

_____

_____

_____

(2)

8.3 The administrator has written the following query:

SELECT Agent, COUNT(*) AS OnTime
FROM Orders
WHERE OnTime = Yes
GROUP BY Agent

8.3.1 Why would this query have been written, i.e. what **useful information** will it provide for the **Pizza World** branch manager?

_____

_____

_____

_____

(2)

8.3.2 Complete the following table to show the result set generated by this query. The first row should be used to show the headings of the result set, and the following rows the values generated by the query. Use the data in the original table shown at the start of this section.

Agent	

(4)

8.3.3 The administrator now adds the following line at the end of the query:

HAVING COUNT(*) >= 2

(a) What is the difference between a HAVING and a WHERE clause?

_____

_____

_____

_____
(2)

(b) Explain what effect this will have on the result set in 8.3.2.

_____

_____

_____

_____
(2)

8.4   8.4.1 Refer to the **Orders** table once again. The table contains redundant data. What is redundant data?

_____
(1)

8.4.2 Name two fields which contain redundant data.

Field 1: _____

_____
(1)

Field 2: _____

_____
(1)

8.5   Write down the **Orders** relation in relational form.

_____

_____

_____

_____
(3)

8.6   To transform the **Orders** table into the second normal form (2NF), we need to remove partial dependencies.

      8.6.1   Name ONE field that is partially dependent on each of the key fields.

Field	**Dependent on**
	OrderID
	AgentName

(2)

      8.6.2   Write down the relations for the 2NF tables in relational form.

(6)
[34]

QUESTION 9

Pizza World have employed a programmer who will be writing an OOP-based application for them to manage their orders. One of the sections will have a class dealing with orders. The **Order** class will be used to instantiate and operate on **Order** objects. There will also be classes that work with **Pizza** objects and **Agent** objects.

A **Pizza object** will have the following fields and types:

    pizzaBase : string
    basicIngredients : array of string
    extraToppings : array of string

An **Agent object** will have the following fields and types:

    agentName : string
    agentGender : char
    agentPhoneNumber : string

An **Order object** will have the following fields and types:

    orderNumber : integer
    customerName : string
    pizzaOrder : array of Pizza objects (a maximum of 10 pizzas per order)
    deliveryAgent : Agent

9.1   Complete the following class diagram for the **Order class**. Show the declaration of all the fields of the class (which must not be directly accessible from outside the class), as well as methods for the following:

- Parameterised constructor method, accepting the following parameters:
    - oN(integer), cN(string), pO(array of Pizza objects) and dA(Agent);
- Accessor methods for the orderNumber and deliveryAgent fields;
- Mutator methods for the pizzaOrder and deliveryAgent fields, which will accept parameters pO(array of Pizza objects) and dA(Agent) respectively;
- A toString() method which will concatenate the various fields of an Order object into one string object.

Class Name:
Fields
Methods

(10)

9.2   A junior programmer in the IT department questions why the **agentGender** field has been set to the type **char**. He thinks that this field should be a Boolean, which could be set as "True" for female and "False" for male.

Explain, using TWO different reasons, why a field of type char is a better choice for storing an agent's gender.

Reason 1:

(1)

Reason 2:

(1)

9.3   In the process of programming the overall OOP project for **Pizza World**, many other data structures, classes and methods are developed. In one particular class, there is a set of parallel arrays being used to store **agentName** and **agentGender** values.

Sample values in these arrays look as follows:

agentName[0]	agentName[1]	agentName[2]	agentName[3]	agentName[4]
"Hermione"	"Fazul"	"Jimmy"	"Thabo"	"Jia-Haui"

agentGender[0]	agentGender[1]	agentGender[2]	agentGender[3]	agentGender[4]
'F'	'M'	'T'	'M'	'M'

An algorithm has been developed that will accept a string parameter – an agent name – and search through the **agentName** array to see if the name exists. If it does exist, the algorithm will return the corresponding value from the **agentGender** array. This algorithm is given to you in Appendix B on page ii of the Appendix.

9.3.1   You are required to complete the following trace table to test the algorithm. Assume that the parameter **name** has the value "Jimmy".

Array Index	[0]	[1]	[2]	[3]	[4]		
agentName	Hermione	Fazul	Jimmy	Thabo	Jia-Haui		
agentGender	F	M	T	M	M		
Line	**name**	**i**	**pos**	**flag**	**i < size AND flag = false ?**	**name = (agentName [i]) ?**	**Output**
	Jimmy	0	0	false			
1							
2							
4							
5							
1							
2							
4							
5							
1							
2							
3							
4							
5							
1							
6							

(8)

9.3.2   The output from the algorithm is not as expected. This is caused by one line of code being in the incorrect position.

(a)   Identify the line of code that is in the wrong place. It is sufficient to merely give the line number from the algorithm.

(1)

(b)   Suggest how this error could be fixed to ensure the algorithm returns the correct output.

(2)

(c)   What would be a better data structure to use to avoid this type of problem occurring?

(1)
[24]

58 marks

Total: 180 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.