INFORMATION TECHNOLOGY: PAPER I

Time: 3 hours   180 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1.   This question paper consists of 18 pages. 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 ALL questions – there are no options in this paper.

4.   Show all working where applicable.

5.   Non-programmable calculators may be used.

6.   Number your answers exactly as the sub-questions are numbered.

7.   Start each answer to each question on a **new page**.

8.   Please leave a **line open** between sub-questions.

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

SECTION A   SHORT QUESTIONS

QUESTION 1   MULTIPLE CHOICE

Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number, for example 1.11 D.

1.1   Which one of the following products is not an embedded computer?

A   Customer Electronics, e.g. mobile and digital telephones
B   Home Automation Devices and Appliances, e.g. security monitoring systems
C   Process Controllers and Robotics
D   Servers

1.2   Which one of the following types of malware refers to the forging of an email header, so that the email appears to originate from a different source?

A   Spoofing
B   Cracking
C   Pharming
D   Hacking

1.3   Which statement is false?

A   The size of the buffer has no effect on the quality of the video being streamed.
B   Buffering a stream helps with irregular data flow while streaming content.
C   Buffering a stream will remove any choppiness or pauses in the video.
D   Streaming is used when the user's Internet connection speed is faster than the time taken to view the video.

1.4   The term 'caching' refers to ...

A   methods for improving the overall performance of a computer.
B   the process of checking a drive for errors and fixing them.
C   a way of making more hard drive space available.
D   background scanning a computer system for viruses.

1.5   Which one of the following file types is associated with both audio and video content?

A   wav
B   mp3
C   mpeg
D   rtf

1.6   The **least** effective solution to improve the overall performance of an older computer is to ...

A   defragment the hard drive regularly.
B   uninstall seldom used programs.
C   upgrade to an LED monitor with a faster response time.
D   add more RAM.

1.7   Which one of the following best describes the term data mining?

A   Accessing online information about a file.
B   Analytic process exploring large volumes of data.
C   Searching for an object in an Access database.
D   Processing raw data into information.

1.8   The **least** effective way to share a large executable file (.EXE extension) securely with a number of people is to ...

A   make the file downloadable via a link on a password protected web page.
B   attach the file to an email message.
C   upload the file to an FTP server.
D   use the services of Google Drive.

1.9   The specification 802.11b/g/n in an advertisement for a computer means that the computer ...

A   has a Thunderbolt port for high speed data transfer.
B   can be connected to a cabled network.
C   is fitted with a Solid State Drive.
D   has built-in support for WiFi.

1.10   Which of the following devices provides a common central connection point for nodes on a network?

A   Packets and tokens
B   T1 and T3 lines
C   Routers and digital modems
D   Hubs and switches

[10]

QUESTION 2   MATCHING COLUMNS

On the left side of your page, write down only the *number* of the question from Column A, and next to it the correct matching *capital letter* from Column B, for example 2.11 T.

Column A		Column B	
2.1	An Internet service that translates host names into equivalent IP addresses.	A	Access control
2.2	A record that is made to keep track of changes made to a database and when those changes were made.	B	Audit trail
2.3	An error condition that occurs when there are not enough bits available to represent an integer value accurately.	C	Candidate key
2.4	The combination of more than one field to uniquely identify a record.	D	Foreign key
2.5	A document that outlines the rights and responsibilities of users within a network environment, including the consequences of violating these stipulations.	E	AUP
2.6	Interactive websites.	F	DDOS
2.7	The use of software settings and various technologies (ie passwords, encryption codes, biometric security measures) to control users' rights on a network.	G	DNS
2.8	Compressing data by sacrificing some insignificant or virtually undetectable portion of the data.	H	Lossless compression
2.9	A field (not a primary key) that is used as a 'link' to a field in another table (usually the primary key).	I	Composite key
2.10	A simulation of human decision-making processes by a computer system that is programmed to react to input.	J	AI
		K	Lossy compression
		L	Overflow
		M	Web 2.0
		N	Web 1.0

[10]

20 marks

SECTION B   SYSTEM TECHNOLOGIES

SCENARIO

You are assisting a school that has just introduced IT as a subject. The school's computer centre administrator has asked you to help prepare the computers and answer questions related to an introduction course in Game Programming and Responsible Computer Usage. Their centre has 20 computers and an old inkjet printer, connected in a cabled network with Internet connectivity. Students are allowed access to the network but cannot make any changes to course notes on the network drive. Course presenters have rights to access the network and create or edit files in their courses.

PLEASE NOTE: You need to consider the above scenario when answering Questions 3 to 5.

QUESTION 3

Based on the above scenario, consider the specifications for a typical computer, which is in the school's computer centre. Answer the questions that follow:

> 15.6" LED HD (1366 × 768) Display
> Intel® Core™ i3-3210 Processor 3.20 GHz
> 4 GB DDR3 RAM
> 1 TB Hard Drive
> DVD Super Multi Writer
> Intel® HD Graphics shared
> LAN and Wireless LAN
> Bluetooth
> Touchpad
> VGA and HDMI out
> MS Windows 7 Professional 32bit

3.1   This computer has 2 500 times more secondary memory (storage) than primary memory (RAM).
       Briefly explain why it is necessary to have so much more secondary memory or storage compared to primary or main memory by referring to their functions.   (2)

3.2   Why could the computer not play a movie stored on Blu-ray? Motivate your answer.   (1)

3.3   Explain what the specifications VGA and HDMI refer to.   (1)

3.4   Give TWO reasons that would suggest that the computer referred to above is a portable computer, such as a laptop.   (2)

3.5   A similar computer has a better Intel Core i5-3340M processor with a base clock speed of **2.7GHz**.

      3.5.1   Explain why the clock speed is described as a 'base clock' speed.   (2)

      3.5.2   How could the Intel Core i5 with base clock speed of 2.7 GHz be faster than a Core i3 3.2 GHz? Give TWO reasons for your answer without referring to your answer in Question 3.5.1.   (2)

      3.5.3   How does hyper-threading advantage multi-tasking users? Motivate.   (2)

3.6   Explain why the hardware requirements of a package is not a concern if the software were cloud based, e.g. Google Docs.   (2)

3.7   The inkjet printer described in the above scenario is too slow and the purchase of a new printer is being investigated.

      3.7.1   An advertisement for a printer includes the following logo:

            Briefly explain the **advantage** of such a printer, as suggested by the logo.   (1)

      3.7.2   Based on the volumes of printing done in a typical school computer centre, suggest a type of printer that would be more suitable for this computer centre.   (1)

3.8   Explain how airport security screening equipment could damage or erase the data on a mechanical hard disk.   (2)

[18]

QUESTION 4

4.1   In the introduction course to Game Programming, the course presenter discussed different types of programming languages. Some languages use a compiler and some languages use interpreters.

      4.1.1   Distinguish between compilers and interpreters.   (2)

      4.1.2   Give an example of each.   (2)

4.2   The centre administrator wants to archive certain files on the server, in order to free up disk space.

      4.2.1   Explain what is meant by archiving files, and why this can lead to saving disk space on the server.   (2)

      4.2.2   If you moved archived files from a physical server to a virtual server, will it save space? Justify your answer by referring to a virtual server.   (3)

4.3   The school discourages the use of flash drives to transfer files, because of the risk of malware infection. As an alternative they use cloud storage or shared network drives.

      4.3.1   Motivate why companies sometimes discourage flash drives by referring to any practical reason they might have, besides the risk of spreading malware such as viruses.   (2)

      4.3.2   Name the cloud computing service that allows you to create, for example, a slide presentation.   (1)

      4.3.3   Is data stored in the Cloud free from prying eyes? Motivate your answer.   (2)

      4.3.4   Would you synchronise your video presentation courses to the Cloud? Motivate.   (2)

      4.3.5   Give TWO advantages of cloud computing.   (2)

4.4   The course presenter has a new headset that will be used to record his voice while he gives a presentation.

      4.4.1   Explain the process that will occur to recognise the device when he plugs the headset into the computer for the first time.   (3)

      4.4.2   When the presenter presents his/her course, and records his/her voice, will the operating system use multitasking or multithreading to perform these two functions at the same time? Justify your answer.   (2)

4.5   To conclude the Gaming Programming and Responsible Computer Usage Course, a video conference is being planned, where course members will have the opportunity to interact with a Linux computer programmer in London. The webcam capabilities of the centre's computers are as follows:

<div align="center">

TrueColor technology
1280×720 resolution

</div>

4.5.1   Give the unit in which the resolution 1280×720 is measured.   (1)

4.5.2   Give TWO advantages of using video conferencing to interact with people compared to using a phone.   (2)

4.5.3   Briefly explain what Linux is.   (2)

4.6   The course presenter has hardcopy notes they would like to convert to digital format.

4.6.1   Give the name of the technology, or type of software, you could use to convert the notes into a document that could be edited in a word processor.   (1)

4.6.2   How can you ensure that everybody can open the document, irrespective of the different types of word processing software?   (1)

[30]

48 marks

SECTION C   INTERNET & COMMUNICATION TECHNOLOGIES

QUESTION 5

5.1   The network in the given scenario includes a **file server**.

      5.1.1   Give TWO advantages of having a file server in the network.   (2)

      5.1.2   The server is more 'powerful' than the other computers on the network.

            Give TWO hardware specifications, or factors, that determine how 'powerful' a computer is.   (2)

      5.1.3   The server in the computer centre is connected to the LAN in the administration building by means of fibre optic cable.

            (a)   Give ONE advantage of using fibre optic cable to join computer networks.   (1)

            (b)   Give ONE disadvantage of using fibre optic cable to join computer networks.   (1)

5.2   Course members need to be informed of the various measures available to protect themselves when online.

      5.2.1   Briefly explain what spyware tries to do and give ONE tip on how to minimise the risk of a computer becoming infected with spyware.   (3)

      5.2.2   The network administrator installed a firewall and a proxy server for protection.

            (a)   Briefly explain how a firewall can help protect a computer when it is connected to the Internet.   (2)

            (b)   How does a firewall differ from a proxy server?   (1)

5.3   Some course members intend bringing their own portable devices (laptops, tablets, etc.) to connect to the intranet wirelessly.

      5.3.1   Give ONE advantage that a tablet might have over a normal laptop for the course members, in terms of how data is entered.   (1)

      5.3.2   Briefly explain how an intranet differs from the Internet.   (1)

      5.3.3   Give TWO settings that can be configured for portable devices in order to conserve battery power, besides switching them off when not in use.   (2)

5.4   The use of a smartphone will be a topic of discussion on the course. **Convergence** is a trend whereby separate technologies and functions from multiple devices are combined into a single multi-purpose device.

     5.4.1   Briefly explain how the above trend could be advantageous. Give TWO reasons for your answer.   (2)

     5.4.2   Emails can be 'pushed' from a regular email account to a smartphone.

           Give ONE advantage in having emails 'pushed' to a smartphone for the user to read.   (1)

     5.4.3   Mobile devices sometimes experience difficulty in displaying web pages, on account of their smaller screen size and limited resources.

           Give ONE web design technique that is used to make 'mobile' websites more user-friendly.   (1)

5.5   The course presenter needs assistance from the network administrator and he decided to assist him via remote access. Discuss the difference between remotely controlling a computer with software such as **Remote Desktop Connection** and using a **VPN**.   (4)

5.6   Refer to the computer network that has recently been established at the school in the scenario above. The first priority of the network administrator is to ensure that unauthorised users cannot gain access to confidential data stored in the files on the network.

     5.6.1   One way to restrict the type of access users have to folders is to make use of *permissions*. Explain what this statement means by referring to what a user's permissions are on a network.   (2)

     5.6.2   When public and private encryptions are used, the public key can be made generally available without any compromise of data security. Explain why this is true.   (3)

5.7   Jason, an avid gamer at the school, would like some information on **BitTorrent**. He has also heard that he may need to configure his firewall before using BitTorrent.

     5.7.1   Why is it usually quicker to use BitTorrent to download a file rather than downloading it from a server? Motivate your answer.   (2)

     5.7.2   Someone suggested that BitTorrent should be avoided as it is illegal to use.

           Is this statement true in your opinion? Motivate your answer.   (2)

5.8   Search engines such as Google and Yahoo use both **client-side** and **server-side scripting** to optimise search results. Search engines often use Search Engine Optimisation.

      5.8.1   Briefly describe the **process** of server-side scripting.   (2)

      5.8.2   Why would a web author need to consider Search Engine Optimisation when designing a web page?   (2)

> **37 marks**

SECTION D   SOCIAL IMPLICATIONS

QUESTION 6

6.1   Users of Social networking sites like Facebook can be misled into disclosing personal and private information. This can lead to identity theft and cyberbullying.

        6.1.1   Briefly explain FOUR different Cyber Safety rules.   (4)

        6.1.2   Give THREE reasons why cyberbullying could be more frequent than real-world bullying?   (3)

6.2   Read the following article carefully and then answer the question that follows.

Twitter clashes with free speech laws internationally
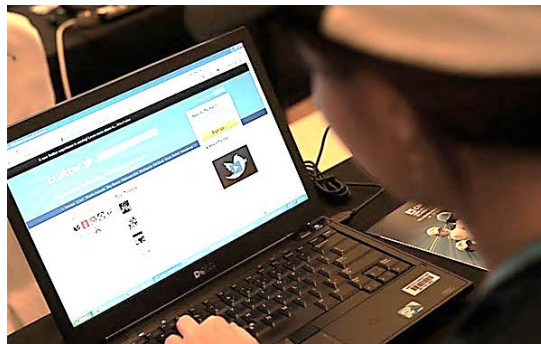
Micro-blogging site Twitter has taken user privacy and free speech very seriously, refusing to hand over information on users who tweet offensive things. Twitter lost an appeal in a French High Court that will require them to release the identities of users who have posted anti-Semitic comments on its site. Twitter has been much more protective of its users' private information than other social media networks. Twitter refused to participate in U.S. government requests for user data. Twitter originally agreed to block tweets using the hashtag #unbonjuif, but refused to hand over identities. However, the court claimed Twitter had violated French laws against hate speech and Holocaust denial, and ordered the company to turn over the users' identities and pay $50 million to organisations that fight racism.

[Taken from: <http://www.pbs.org/newshour>]

        6.2.1   What is a microblog?   (2)

        6.2.2   Twitter decided to block the tag #unbonjuif. What is the purpose of the hashtag in a tweet?   (2)

        6.2.3   Do you think Twitter is right to protect the identity of their users? Justify your answer by providing TWO convincing arguments.   (4)

6.3   Accessing a number of people's computers remotely to use their processing time and power can be regarded either as a positive exercise or as a criminal activity.

        6.3.1   Give ONE beneficial or constructive example of this type of usage.   (1)

        6.3.2   Give ONE example of using it for criminal purposes.   (1)

6.4   Briefly describe LBS (Location Based Services).   (2)

19 marks

SECTION E   DATA AND INFORMATION MANAGEMENT & SOLUTION DEVELOPMENT

QUESTION 7

7.1   Some individuals and small organisations prefer using spreadsheets instead of databases to maintain data.

      7.1.1   Discuss why databases are a more appropriate solution.   (2)

      7.1.2   What is the **broad term** that refers to maintaining the accuracy, reliability and consistency of data stored in a database?   (1)

      7.1.3   What is the **process** of ensuring that data meets a set of requirements, e.g. that a value must for example be a whole number?   (1)

7.2   Who would be involved in the designing of the database, the Database Analyst or the Database Administrator? Justify your answer.   (2)
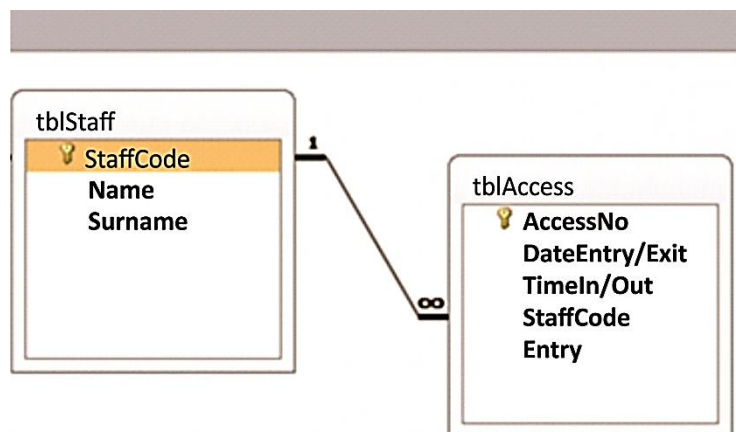
7.3   A college requires a database that keeps a record of all persons entering and exiting the college grounds. The security company has installed a bar-coded ID card system and cameras to control the access points. The design of the database to be used needs to be carefully considered.

The **SecurityDB** database contains two tables, namely **tblStaff** and **tblAccess**. Each individual is allocated a unique code that enables him/her to enter and exit the college grounds. This code is stored along with his/her name and surname in the **tblStaff** table. The date and time that authorised people enter and exit the College grounds are stored in the table named **tblAccess**. The Entry field in the table **tblAccess** stores a true if the staff member enters and false if they exit.

The table structures are shown below:

tblStaff	
Field Name	**Data Type**
StaffCode	Text
Name	Text
Surname	Text

tblAccess	
Field Name	**Data Type**
AccessNo	AutoNumber
DateEntry/Exit	Date/Time
TimeIn/Out	Date/Time
StaffCode	Text
Entry	Boolean

```
tblStaff                        tblAccess
  StaffCode          1            AccessNo
  Name                            DateEntry/Exit
  Surname                ∞        TimeIn/Out
                                  StaffCode
                                  Entry
```

7.3.1   The personal information of each staff member must be grouped together to be captured in a **tblStaff** table. Which term is given to the group of fields related to one staff member?   (1)

7.3.2   Which term is used for extracting data from a database, using specific criteria?   (1)

7.3.3   Name the type of relationship between the **tblStaff** table and the **tblAccess** table.   (1)

7.3.4   The **StaffCode** field appears in the **tblStaff** table as the primary key. This field also appears in the **tblAccess**. What is the purpose of the **StaffCode** field in the **tblAccess** table? (2)

7.3.5   Give a reason why 'AutoNumber' is the most suitable data type for the **AccessNo** field in the **tblAccess** table. (1)

7.3.6   Consider the following SQL statement and then answer the question that follows:

SELECT   LEFT(Name,1)   &   LEFT(Surname,1)   &   "-"   &   INT(RND(EntryNo)*100) AS SecretCode
FROM tblStaff, tblAccess
WHERE tblStaff.StaffCode = tblAccess.StaffCode

What will the above SQL statement generate? Explain your answer by giving an example of the possible output. (3)

7.3.7   Explain why INT (RND(AccessNo)*100) may not always generate 2 digit numbers. (2)

7.4   Normalisation organises a database to remove anomalies and minimise data redundancy.

A **database table** that was designed to store the records of matric student entries for a variety of schools is seen below.

IDNumber	Surname	Name	School	Principal
9011230078082	Sapuka	Mildred	Vista SSS	Dr Pool
8912250198082	Portola	Beth	Windows College	Mr Smith
9007094135081	Naidoo	Lily	Vista SSS	Dr Pool
9010120001082	Antis	Ursula	Vista SSS	Dr Pool
9011250076084	Uys	Marie	Windows College	Mr Smith
9006095678082	Nyman	Karl	H/S Parkview	Mr Savage
9112215467086	Johns	Kevin	Vista SSS	Dr Pool
9001010123087	Evans	Tilley	Windows College	Mr Smith
9002045080082	Joubert	Hannah	H/S Parkview	Mr Savage

7.4.1   A badly designed database will result in anomalies. Name and describe one such anomaly that could occur with the above table assuming the primary key is **IDNumber**. (2)

7.4.2   Many databases are normalised to second normal form (2NF). Why is it necessary to normalise to third normal form (3NF)? (2)

7.4.3   Normalise the above table now to **3NF** and write your answer down as a set of relations. (6)

[27]

QUESTION 8

8.1   Create an algorithm for the following scenario:

A young man has borrowed R10 000, at an interest rate of 20% per annum. The interest is added at the start of the year, based on the balance due at that time. It means that if he paid back the money the very next day after borrowing it, he would still have to pay the 20% interest for the year.

He opts to pay R3 000 every year.

You need to write an **algorithm** to compute how many years it will take him to clear his debt.

Hint: *Interest = rate/100 * amount*   (7)

8.2   In programming, Object Oriented Programming (OOP) is used extensively.

8.2.1   In the context of programming, explain why access modifiers are necessary.   (2)

8.2.2   Objects are not always necessary in programming.

(a)   Describe a scenario/problem that WILL NOT benefit with the use of objects.   (2)

(b)   Describe a scenario/problem that WILL benefit from the use of objects.   (2)

8.2.3   Give an example where a field may be defined as a constant (final).   (2)

8.3   Statistics regarding the number of visitors entering the school grounds need to be recorded. The programmer decides to use an array containing the test data for planning purposes. Answer the following question based on arrays.

8.3.1   One way of populating an array is to use input from the keyboard. State TWO other ways of populating an array.   (2)

8.3.2 Study the algorithm below that supposedly calculates and displays the average number of visitors per day, and then displays the days on which the number of visitors exceeded the average number of visitors per week. The algorithm reads the total number of visitors for each day of the week from the keyboard as test data. The days of the week are Monday, Tuesday, Wednesday, Thursday and Friday.

visitArr is an array with a maximum of 5 values to store the number of visitors per day. **daysArr** contains the names of the days of the week.

Line Number	Description
3	total = 0
4	Input numVisitors
5	loop 5 times
6	Input numVisitors
7	visitArr[loop] ←numVisitors
8	Total ← Total + visitArr[loop]
9	End loop
10	Display average
11	loop 5 times
12	If visitArr[Total] > average
13	Display daysArr[loop]
14	End loop

(a) Redraw the following diagram representing the **visitArr** in your answer book.

visitArr

(i) Use the given algorithm and the following test data to populate **visitArr** in your answer book:

Test data: 8, 6, 9, 4, 1   (2)

(ii) The array has been incorrectly populated because of an error occurring between line numbers 3 and 9. Explain how the algorithm must be changed in order to correct the error.   (2)

      (b)   Assume that the error in the algorithm (referred to in Question 8.3.2(a)(ii)) has been corrected and that the array has been populated with the following values:

visitArr

8	6	9	4	1

The following is displayed by statements 10 to 14 of the algorithm:

> 0
> Monday
> Tuesday
> Wednesday
> Thursday
> Friday

Rewrite lines 10 onwards to display the correct average and the names of the days on which the number of visitors exceeds the average number of visitors per week.

NOTE: Additional statements might be required.   (4)

8.4   Below is an extraction of a sort algorithm which sorts names alphabetically:

```
Declare variables: integer count1, count2
temp :tStudentClass
  Begin
  Loop count1 from 1 to the length of the Array – 1
  Begin
  Loop count2 from count1 + 1 to the length of the Array
  Begin
  Check if  tStudentArr[count1].getName  >  tStudentArr[count2].getName
  Begin
            temp ← tStudentArr[count1]
            tStudentArr [count1] ←tStudentArr[count2]
            tStudentArr[count2] ← temp
        endIf
  endLoop (inner)
endLoop (outer)
endMethod
```

Re-write the above algorithm to sort on TWO fields – the person's surname and then the person's first name.   (4)

                  [29]

56 marks

Total: 180 marks