GCE A level

1103/01

COMPUTING CG3

P.M. TUESDAY, 12 June 2012

3 hours

1103
010001

ADDITIONAL MATERIAL

In addition to this examination paper you will need a 20 page answer book.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

Answer **all** questions.

Use both sides of the paper. Write only within the white areas of the book.
Write the question number in the boxes in the left hand margin at the start of each answer.

Leave at least two line spaces between each answer.

The intended marks for questions or part questions are given in brackets [ ]. You are advised to divide your time accordingly. The total number of marks available is 100.

You are reminded of the necessity for good written communication and orderly presentation in your answers.

Quality of written communication will be assessed in question 26.

0 1 State a computer application where a queue is the most appropriate data structure, and explain why it is the most appropriate data structure to use. [2]

0 2 State a computer application where a stack is the most appropriate data structure, and explain why it is the most appropriate data structure to use. [2]

0 3 Describe **in detail** three possible drawbacks for customers using *on-line shopping*. [3]

0 4 Two methods of data transmission are *half duplex* and *full duplex*. Describe what is meant by each of these terms. [2]

0 5 Giving an example, explain why a *network protocol* is necessary. [2]

0 6 Describe what is meant by a *data collision* on a network. What should happen once a data collision is detected? [2]

0 7 Two unrelated terms used in computing are:

- *parallel transmission of data*
- *parallel processing*

Explain what each means, and give an example of where *parallel processing* might be useful. [3]

0 8 Despite recent developments, the *graphical user interface (GUI)* remains an extremely common form of human computer interface (HCI).

Describe **in detail** the benefits to users of a GUI. [5]

0 9 The security officer in a pharmaceuticals factory has decided to use biometrics to control access into a sensitive area of the factory. One type of biometrics under consideration is *voiceprint recognition*. Describe how *voiceprint recognition* might be used in this case. [3]

1 0 A computer system uses the exclusive OR (XOR) logical operator to encrypt data before it is transmitted along a network. Draw the truth table for the XOR logical operator and use a worked example (using 8 bits) to demonstrate how data is encrypted using this method, including how the original data is decrypted. [3]

1 1 Explain what is meant by the term algorithm. [2]

12 *Quicksort* is a *recursive* sort algorithm. Explain the term *recursive algorithm* and state why *quicksort* is often used.

Briefly describe how *quicksort* operates. [6]

13 *Interrupts* are often generated in a computer system. Describe what will happen if, while one interrupt is being processed, another with a higher priority arises. Describe a situation in which a high-priority interrupt may be generated. [4]

14 A large network has many thousands of users, each of whom has a unique six digit user id and a password. A *random access file* is used to store all the encrypted passwords, with the user id being used as the key field.

Explain **in detail** how a random access file operates, using the situation described above as an example. [6]

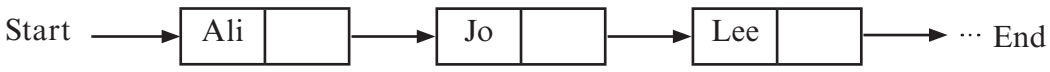
15 In a certain computer, integers are stored using *sign/magnitude* representation and 16 binary digits. The left hand bit is set to zero for a positive number.

Find the integer represented by the binary number 1000000000001001 [1]

16 In other computers, integers are stored using *two's complement* representation. Describe, using an example, how the *two's complement* of a binary number is derived. [3]

17 The *ASCII character set* is often used in computer systems.
Why is it useful to use character sets such as ASCII? [1]
The decimal ASCII code for "N" is 78. What will be the decimal ASCII code for "L"? [1]

18 A linked list contains a number of names in alphabetic order. The following diagram represents part of the linked list.



Copy the diagram and show how the name Eric would be inserted. [3]

1 9 In a car factory, a number of tasks are carried out by *robots*. Explain what is meant by a robot and describe how robots might be used in a car factory. Discuss the benefits and drawbacks of using robots for the owners of the car factory. [7]

2 0 Explain **in detail** how a multiprogramming computer system works. Your answer should include an explanation of *scheduling* and *polling*. [6]

2 1 In a certain programming language a variable name is made up of letters (which can be upper case or lower case), digits, or the underscore character (_). The first character must be an upper case letter. The name may be of any length.

For instance, the following are permitted as variable names in this language:

X Sales SALES_Total SaLeS2011

Produce a Backus-Naur Form (BNF) definition for a variable name in this language. [4]

2 2 Databases are often *normalised*. Define the term *third normal form* and explain why databases are often normalised. [4]

2 3 Patients may be admitted to a large hospital several times. For each admission they are allocated to one ward and to one doctor - these may be different if the same patient is admitted again.

The table below shows a small sample of patients, their doctors and other information.

Patient Code	Patient Name	Patient DOB	Admission Date	Ward Name	Number of Beds	Doctor Code	Doctor Name	Doctor Page Number
245442	Fletcher	18/07/1944	12/08/2010	Berwyn	22	D137	Holt	672
245442	Fletcher	18/07/1944	17/04/2012	Dyfnant	16	D339	Barber	622
38200	Iqbal	01/03/1990	18/09/2011	Clocaenog	30	D097	Phitides	677
31859	Anderson	12/09/1981	03/02/2012	Berwyn	22	D137	Holt	672
32009	Evans	28/06/1973	12/01/2010	Clocaenog	30	D222	Charytowicz	691
31859	Anderson	12/09/1981	29/02/2012	Berwyn	22	D137	Holt	672
23117	Li	12/12/1991	12/03/2012	Elenith	19	D339	Barber	622

Construct an entity relationship diagram for this situation. [3]

2 4 For the situation described in question 23 restructure the table shown into third normal form using four tables.

There is no need to copy the items of data. [6]

2 5 Scientists are monitoring the level of a pollutant in a river. They take a number of readings of the level of pollutant then use a computer to analyse the data.

Design an algorithm, using pseudo-code, with the following inputs:

- the number of readings to be analysed
- the readings themselves

The algorithm should read the readings into an **array** then output:

- the mean of the readings
- how many readings were above the mean
- the highest reading

For instance, if the inputs are:

5
122 126 115 121 116

The output should be similar to:

Mean reading = 120
Number of readings above mean = 3
Highest reading = 126 [6]

2 6 When a software development team is developing a suite of computer programs, there are many tools available to them. These include:

- CASE (Computer Aided Software Engineering) tools
- application generators
- compilers
- debuggers.

Describe these software tools and discuss their role in developing software. [10]