

Candidate Surname	Centre Number	Candidate Number
Other Names		2



GCE A level

1103/01

COMPUTING CG3

P.M. WEDNESDAY, 26 January 2011

3 hours

INSTRUCTIONS TO CANDIDATES

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

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Answers should be written in the spaces provided. Where space is not sufficient use a continuation sheet, taking care to number the continuation correctly.

The intended marks for questions or parts of 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. The quality of written communication will be assessed in question 16.



J A N 1 1 1 1 0 3 0 1 0 1

4. (a) (i) Write down the effect of carrying out an **arithmetic shift left by two places** on the eight-bit positive integer **00001111** and state the effect of this operation on the number. [2]

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- (ii) If an **arithmetic shift left by two places** was carried out on the eight-bit positive integer **01001111**, a problem would arise. Name and describe the problem. [2]

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- (b) (i) Show how the number -7_{10} is represented in *two's complement* form using 8 bits. [1]

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- (ii) **Showing all your working**, demonstrate that -3_{10} is the result of the binary addition of -7_{10} and 4_{10} . [2]

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- 5. Security is very important in many areas of life, for instance in controlling staff access to government buildings. *Biometrics* are often used to increase security in this situation.

Describe how *iris scanning* might be used in this situation and name one other type of biometric. [4]

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6. (a) Describe in detail what is meant by an *indexed sequential file*, and give the main advantages of using an *indexed sequential file* compared with both standard *sequential files* and *random access files*. [4]

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- (b) Why is data held on computer files often *encrypted*? [1]

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- (c) Data held in computer files is often *archived*. Explain what is meant by the term *archiving* and explain why archiving is necessary. [3]

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7. (a) A control system is required to close the windows on a commercial greenhouse when at least one of the following conditions is true:
- the wind speed rises above 12 km per hour
 - it is raining.

Name the logical operation required in this case and draw a truth table for this logical operation. [2]

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- (b) A control system is required to turn on a sprinkler system in a field when both of the following conditions are true:
- the temperature rises above 25° Celsius
 - it has not rained in the last 5 days.

Name the logical operation required in this case and draw a truth table for this logical operation. [2]

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8. (a) Briefly describe how a *bubble sort* operates. Name a recursive sort algorithm which is usually faster than a bubble sort. [3]

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- (b) An algorithm is written for a bubble sort in one particular application. The input to the algorithm is a set of 6 positive integers.

One set of data which would test this algorithm is:

45 32 5 35 19 62

Write down two other sets of data which will more fully test the algorithm. [2]

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9. (a) Many computer systems now use *speech recognition* as a means of input. Describe possible ambiguity problems associated with speech recognition as a means of input. [2]

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(b) What benefits would arise if a reliable *natural language* interface was developed? Why is this difficult to achieve? [2]

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(c) When a system has been designed, a *design review* is often undertaken. Describe what should take place during a design review. [2]

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(d) A *trackerball* or a *touchpad* is often used on some computers instead of a mouse. Give one reason why this might be the case. [1]

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10. Very large and expensive computer systems are used in forecasting the weather. Explain why such systems are needed in this application. [5]

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11. (a) What is the function of a *translation program* when applied to high-level source code in a computer? [1]

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(b) What is the function of an *assembler program* in a computer? In what circumstances might a programmer choose to use an assembler program? [2]

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12. (a) Explain what a *router* is and describe its main function. [2]

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(b) Why is *switching* necessary in a networked computer system? [1]

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(c) Why is data usually transmitted in digital form rather than in analogue form? [1]

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13. (a) State the main difference between a flat file system and a relational database. [1]

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(b) State what is meant by the following two terms in a database:
• *a primary key*
• *a foreign key* [2]

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(c) Describe the benefits of normalising the data in a database. [3]

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- (d) *MidWales Carriers* employs a number of drivers for its vehicles. Each driver is based at just one depot (for instance Aberystwyth or Newtown) and each depot has a full address, telephone number and a supervisor. Each driver has an ID number, name and home address, and is based at just one depot. Each vehicle has a registration number, make and model, and is also based at just one depot. Each supervisor (who may be the supervisor for more than one depot) has an ID number and a home address.

A database is required by *MidWales Carriers* to store the data required.

- (i) Construct an entity-relationship diagram to illustrate the above situation. [3]

- (ii) Design a database for the above situation in third normal form. [6]



14. Backus-Naur Form (BNF) is often used to define the syntax of a programming language.

(a) Describe why a natural language (such as English or Welsh) is not suitable for this purpose. [1]

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(b) One way of defining a decimal number is:

- no sign or a plus sign or a minus sign
followed by
- one or more digits
followed by
- a decimal point
followed by
- no digits **OR** one or more digits

For instance, the following are covered by this definition:

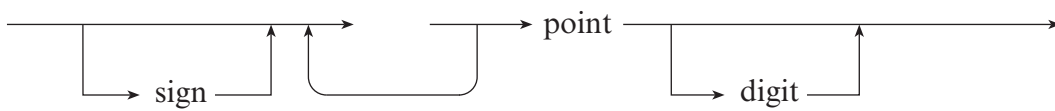
+41.6 41.6 0.0 12. -0.625

Produce an appropriate BNF definition for a decimal number as defined above. [4]

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- (c) The following incomplete syntax diagram is intended to illustrate the same definition of a decimal number.



Complete the diagram above.

[2]



- 15. A prize is awarded to the student or students who gain the highest mark in a particular examination. If more than one student gains the highest mark, each of the students gaining this mark is awarded a prize. All marks are positive integers.

Design an algorithm, using pseudo-code or a high level programming language, with inputs:

- the number of students in the group
- the mark for each student

Its outputs should be:

- the maximum mark
- the number of prizes

For instance if the inputs are:

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17 16 11 17 16 17 14 12

the outputs should be similar to

Maximum Mark = 17
Number of Prizes = 3

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