UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7117681918

COMPUTING **9691/33**

Paper 3 **October/November 2011**

2 hours

Candidates answer on the Question Paper.

No additional materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names for software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **12** printed pages.

For Examiner's Use

1 **(a)** State what is meant by the boot (bootstrap) program.

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(b) Explain how the boot program is used when a PC is turned on.

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For Examiner's Use

2 **(a)** Describe the use of the Memory Data Register (MDR).
Explain how the contents change during the fetch-execute cycle.

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(b) Name **three** types of bus that are used in a computer. For each one explain what it is used for.

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For Examiner's Use

3 **(a)** Convert the following denary numbers into 8-bit, sign and magnitude, binary numbers:

(i) +39

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(ii) - 47

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..... [3]

(b) Convert the following denary numbers into 8-bit, two's complement, binary numbers:

(i) - 3

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..... [2]

(ii) - 47

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..... [2]

For Examiner's Use

(c) A particular computer uses a single 10-bit word to store a floating-point representation of a number.
The first 6 bits are used to store the mantissa and the remaining 4 bits are used to store the exponent.

(i) Explain why 000101 0100 = $2\frac{1}{2}$ using this notation.

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(ii) Rewrite the binary value of this floating-point representation so that it is in normalised form.

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(iii) 011001 0011 is a normalised floating-point number.

By converting each of the mantissa and the exponent into a denary number first, write this number in denary.

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For Examiner's Use

4 The health system in a country consists of a number of local surgeries. Individual doctors give medical assistance to people in the immediate area. In addition to this there are a number of main hospitals. Each hospital provides services which the doctors are unable to provide in their surgeries.
The main hospitals and the surgeries which they serve are linked by using an intranet.

(a) Describe what is meant by an intranet.

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(b) Explain the advantages and disadvantages of using an intranet rather than the Internet.

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For Examiner's Use

5 A new car is being designed. It is decided that different designs for the braking system should be tested using a computer simulation of each design rather than building prototypes.

(a) Describe **three** advantages of using computer simulation when testing each design.

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(b) Simulation allows for the braking system to be tested in different conditions.
Describe the variables in the simulation that would need to be changed in order to replicate different driving conditions.

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For Examiner's Use

6 **(a)** Describe the advantages of using a relational database to store data rather than a flat file.

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(b) Data about guests in a hotel are stored in a relational database. One part of the database consists of a table of GUEST details. This is linked to a table ACCOUNT. Whenever a guest orders something in the hotel, the charge for that service is stored in the ACCOUNT table.

(i) State the primary key of the GUEST table, justifying your choice.

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(ii) State a secondary key in the ACCOUNT table, justifying your choice.

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(iii) State what is meant by a foreign key.

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(iv) State a foreign key in the ACCOUNT table, justifying your choice.

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For Examiner's Use

7 **(a)** Explain how variables are managed during the different stages of compilation of a high-level language program.

[7]

(b) **(i)** Give **two** advantages of using a compiler rather than an interpreter to translate a high-level language program.

[2]

(ii) Describe an advantage of using an interpreter rather than a compiler to translate a high-level language program.

[2]

For Examiner's Use

8 Explain how the following memory management techniques may be used:

(i) Paging

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(ii) Segmentation

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9 **(a)** State the meaning of the following types of programming paradigm:

(i) Declarative

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(ii) Procedural

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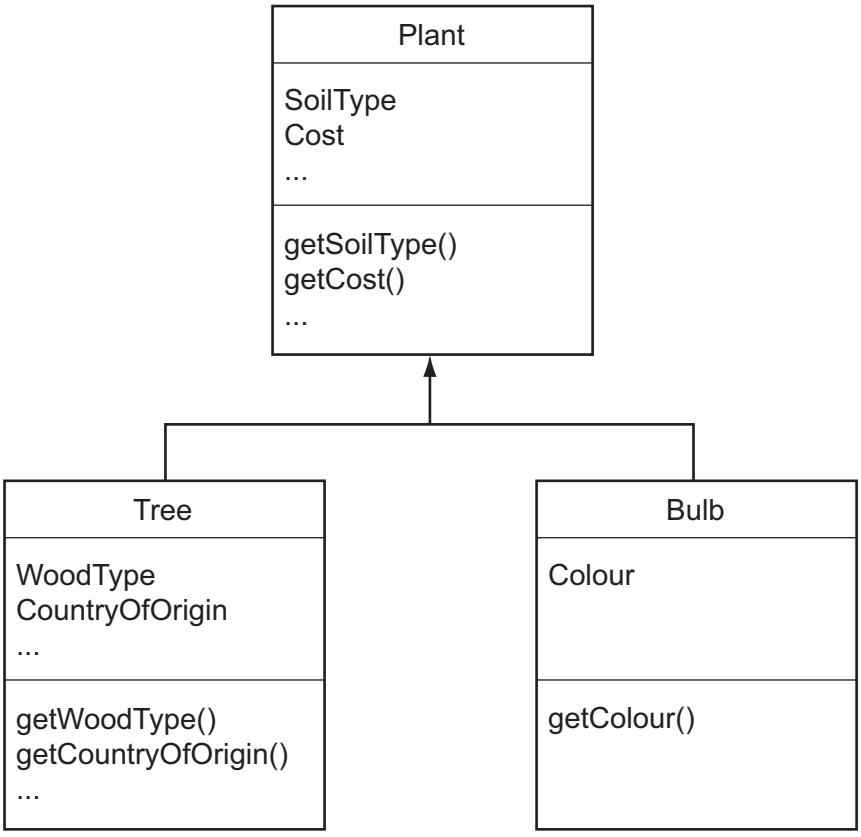
For Examiner's Use

(b) The class diagram shows some of the information about plants on sale in a garden centre.



Use the diagram to help you explain the meaning of the terms:

(i) Class

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(ii) Inheritance

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(iii) Encapsulation

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For Examiner's Use

10 Workers in a factory each have an identity code which identifies their record in the computer system.
The identity code contains letters and numbers and is defined using BNF (Backus-Naur form) as:

<identity-code> ::= <group> | <group><number>
<group> ::= <letter> | <letter><group>
<letter> ::= A | B | C | D
<number> ::= <digit> | <digit><digit>
<digit> ::= 0 | 1 | 2

(a) Explain why each of the following identity codes is invalid:

(i) 2BA

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(ii) XAA

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(iii) ACB021

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..... [3]

(b) The definition is changed to allow only a number which begins with a 1 or a 2. The first digit in the number is now defined as

<non-zero-digit> ::= 1 | 2

Draw a syntax diagram to show the definition of an identity code using only the terms:

- non-zero-digit
- digit
- letter
- identity-code

[4]