



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Advanced Level

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**COMPUTING**

**9691/33**

Paper 3

**May/June 2010**

**2 hours**

Additional Materials: Answer Booklet/Paper

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**READ THESE INSTRUCTIONS FIRST**

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.

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.

Answer **all** questions.

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.

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This document consists of **4** printed pages.



\* 5 7 9 3 9 4 8 6 4 3 \*

- 1 (a) Explain the differences between the lexical analysis stage and the syntax analysis stage of the compilation of a high level language program.
- (b) One phase of compilation is the code generation phase. Describe the code generation phase.
- (c) Explain the purpose of a loader. [2]
- 2 A company uses a computerised payroll system. The company has two factories and employees only work in one of the factories. Each factory employs a large number of workers. Details of the work done by employees each week is stored serially in two transaction files, one for each factory. When these files are used to create the payroll at the end of the week they have to be merged into a single, sequential file.
- (a) (i) State why it is necessary to create the transaction files in serial form. [1]
- (ii) State why it is necessary to turn the transaction files into a sequential file. [1]
- (b) The final transaction file (T) is the result of merging the two sorted files from the two factories (A and B).
- (i) Describe an algorithm that will merge A and B to form T. [5]
- (ii) Describe a binary search algorithm that can be used to find the details of a particular employee with ID number 21478 after the files have been merged. [5]
- 3 A factory makes washing machines. Part of the manufacturing process is to insert the control system behind the control panel in the body of the machine and to screw it into place. This process is done by a robot.
- (a) State **two** types of sensor which would be needed to provide input to the robot, explaining why each is necessary. [4]
- (b) Discuss the use of other types of robotic device in the washing machine factory. [6]
- 4 (a) Describe a hierarchical database. [2]
- (b) PATIENTs in a hospital are arranged in WARDs. Each WARD has a number of BEDs. The STAFF of the hospital are either DOCTORs or NURSEs.
- Draw a diagram to represent the details given above in the form of a hierarchical database. [6]
- 5 The management of a new hospital have decided to install a network of computers. The computers will be placed in the wards and in the doctors' examination rooms so that the medical personnel can have access to the patients' records. They will also be networked in the administration offices so that hospital records can be kept.
- Discuss different topologies and the media available for transmitting data around the network. [6]

- 6 (a) A job which is being processed is in one of three states: ready, running or blocked. Explain how the scheduler manages jobs in the processor.
- (b) State two types of scheduling algorithm.
- 7 Computer technology is to be introduced to a factory. The workers will need to be trained to use the new systems which will be introduced. A decision is made that training courses will be produced on DVDs which will be given to the workers rather than having face-to-face courses with trainers.
- Describe the advantages and disadvantages of training the workers in this way. [6]
- 8 State what is stored in each of the following special purpose registers in a computer and explain how the contents are altered during the fetch/execute cycle.
- (i) PC (or SCR) [3]
- (ii) CIR [3]
- (iii) IR (Index Register) [3]
- 9 A shop uses two computer systems.
- System 1  
Each evening details of the sales during the day are collected together. They are then used to update the stock file.
- System 2  
At the checkout, goods being bought are identified by the system. Details are given to the customer along with the total amount owed.
- (a) Explain why the response times in these two systems will be different. [3]
- (b) Describe the hardware, software and the way that data is organised and processed in the two systems. [8]

10 A VARIABLE is defined in a certain language by the following BNF rules:

```
<VARIABLE> ::= <GROUP><IDENTIFIER> | <GROUP>
<GROUP> ::= <LETTER> | <LETTER><DIGIT> | <LETTER><GROUP>
<LETTER> ::= A | B | C
<DIGIT> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9
<IDENTIFIER> ::= % | $
```

(a) Explain why each of the following is **not** a variable:

(i) D2% [1]

(ii) \$C2 [1]

(b) MAIN\_VARIABLE is defined as a GROUP which has a NZDIGIT (a DIGIT which must not be a zero) as the first character and cannot include an IDENTIFIER, but has a ! or a & as the last character.

For example 1A2! and 9BC& are examples of MAIN\_VARIABLE but 0A2! and 9BC%& are not examples of MAIN\_VARIABLE.

Produce a set of rules to define MAIN\_VARIABLE (The BNF rules stated above do not need to be reproduced). [3]

(c) Draw a syntax diagram of VARIABLE. You may use DIGIT, LETTER and IDENTIFIER in your diagram but no other values. [4]