



MARCH 2017

PROGRAMMING

Instructions to candidates:

- Time allowed: Three hours (plus an extra ten minutes' reading time at the start – do not write anything during this time)
- Answer ALL parts of Question 1 (40 marks) and any FOUR other questions (15 marks each)
- Marks for subsections of questions are shown in []
- Spend about 1 hour on Question 1 and just under 30 minutes on each other question. Read CAREFULLY the particular instructions for Question 1
- State at the top of your answer FOR EACH QUESTION, where appropriate, the programming language and version you are using for that question. Different languages may be used
- Ensure that you pay particular attention to words underlined, in CAPITALS or in **bold**. FEW OR NO MARKS will be awarded to any question where these are ignored
- No computer equipment, books or notes may be used in this examination

General instructions for QUESTION 1: Answer **all** parts of this question.

- Provide high-level language solutions to each question in this section
- Do NOT provide coding for anything outside the question – complete programs are NOT required
- Do not change the names of variables or file names in your answers
- Data only needs to be input where the question specifically states “INPUT”
- Any additional temporary variables YOU introduce must have clear meaningful names and be assigned with initial values

- A landscape gardener needs a program to help him calculate materials and costs for laying paths and driveways. Write a routine to input the **length** and **width** (in metres) of a rectangular space and also the **price** of square paving slabs (£P each). Then determine the number of these slabs which will be needed to cover the area completely. Each slab is 0.5 m long. Determine also the total cost of the slabs. Output the two calculated values.
Note: the length and/or the width of the space will not necessarily be multiples of 0.5 m. [12]
 - Employee details are kept in a SEQUENTIAL file (called STAFF) as follows:

EmployeeName	String	25 characters
EmployeeNumber	Integer	5 digits
DeptCode	Character	1 character (range A-G)
YearJoined	Integer	4 digits (e.g. 1998)
MonthJoined	Integer	2 digits (range 1-12)

All employees are given a personal development interview in the month which is exactly one year after they joined the company and thereafter in the same month each year. Departmental managers can request a list of their own employees who should be interviewed in the next month.
Write a program to print this list showing all fields.
The program first inputs (A) the month required and (B) the department code.
It then prints the list in table form, with a suitable heading. The first four fields should be output. [12]
 - Write a program which will allow two players to play the Guess-the-Word game. At the start of each game each player has 5 “lives”.
Player 1 types in a word without player 2 being able to see. When Player 1 presses Enter the screen will display an asterisk (*) for each letter in the word so that the second player knows how many letters he/she needs to guess.
The program needs to check the length of the word and store each letter of the word **separately**.
Player 2 types in a letter and the program checks to see if that letter appears in the hidden word – if the letter is in the word, the hyphens are replaced for **every instance** of that letter. If the letter **does not** appear in the word, Player 2 loses a “life”.
If the word is guessed before the 5 “lives” are used up, the game will end and Player 2 wins a point. If the word is **not** guessed, Player 1 wins a point.

Question 1 continues overleaf

Allow the game to run for 3 rounds (each player has 3 opportunities to enter a word and 3 opportunities to guess the word).

The program will need to make sure that the 5 lives are restored at the beginning of each round. The program also needs to store the **accumulated** points each player wins.

At the end display a message showing who the winner is and how many points they have. [16]

2. a) Name two **distinctly different** types of program documentation and for each:
- state who would be involved in creating it [2]
 - describe typical contents [10]
 - explain who would use it and why [3]
3. A college allows students to enrol for courses online.
- a) State THREE items that would automatically appear on an online application form. [3]
- b) State THREE things that the programmer needs to consider when designing the online form and give reasons for EACH. [6]
- c) Use a whole page of your answer book to design the layout of the online enrolment form. [6]
4. a) Three common methods of representing algorithms are:
- flowcharts
 - pseudocode
 - decision tables
- Write a brief description of EACH one – support your explanation with a small example. [6]
- b) Give ONE advantage and ONE disadvantage of EACH method. [6]
- c) Write definitions for the following constructs:
- i Sequence
 - ii Selection
 - iii Iteration
- You can use examples to support your definitions. [3]
5. a) List the stages that occur during the translation process from HIGH-LEVEL source code to OBJECT code as performed by a compiler. [7]
- For EACH stage, describe in detail the tasks the compiler performs.
- b) In the ASSEMBLY process, define the following FOUR terms:
- i Two-pass
 - ii Directive
 - iii Forward referencing
 - iv Macro [8]
6. Devise an ALGORITHM (pseudocode or flowchart) for the following program:
- A famous ecological problem involves the survival of a predator (e.g. lion) and its prey (e.g. antelope) in a confined area. When the lions kill many of their prey, their food is reduced and so the lion population falls allowing the prey population to recover. In theory, the populations should rise and fall in cycles. Suppose A is the antelope population and L is the lion population. CHANGES to the populations are given by:
- CHANGE to antelope population = $(4 \times A - 2 \times L \times A) \times \text{time interval}$
- CHANGE to lion population = $(L \times A - 3 \times L) \times \text{time interval}$
- The algorithm should:
- Input the initial starting populations for A and L
 - Perform 10 time intervals of 0.1 before printing the new population values and then repeat this process 50 times [15]
7. a) State the differences between data files and program files. [4]
- b) Give an example of a program that would require one or more data files. [3]
- c) For your given example, describe the structure and likely contents of ONE of the data files. [8]
8. a) Distinguish between high-level and assembly languages. [4]
- b) List the THREE main stages of compilation. Describe the processes that occur in EACH stage. [6]
- c) Memory stores P and Q contain two numbers. It is required to place in store Q the sum of these two numbers.
- i Write a short assembly language routine to perform this task.
 - ii Explain the actions of EACH of the instructions you use. [5]