



DECEMBER 2016

PROGRAMMING

**Instructions to candidates:**

- a) Time allowed: Three hours (plus an extra ten minutes' reading time at the start – do not write anything during this time)
- b) Answer ALL parts of Question 1 (40 marks) and any FOUR other questions (15 marks each)
- c) Marks for subsections of questions are shown in [ ]
- d) Spend about 1 hour on Question 1 and just under 30 minutes on each other question. Read CAREFULLY the particular instructions for Question 1
- e) 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
- f) 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
- g) 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

1. a) Write programming code for a procedure that will **validate** the input of **any** telephone number in the format (07878) 111222. An error message is displayed if the input is not valid. [10]  
The procedure needs to make sure:
  - The number of characters is correct
  - Only valid characters are allowed
  - The first digit must be zero
  - Brackets are in the correct place
  - There is a space between the closing bracket and the next digit
- b) Write instructions to input, for a SINGLE employee, the weekly hours worked and the hourly rate of pay. Then output both these values together with:  
(A) pay before tax is deducted, (B) tax due and (C) pay after tax has been applied.  
Provide suitable explanatory text messages for each. The special conditions are:
  - If the hours worked are more than 40 hours, the employee is paid overtime rate for the **extra** hours at 1.5 times the normal rate
  - Tax is paid at 25% on all earnings over £80 [15]
- c) A SEQUENTIAL employee file (called STAFF) contains personal details of all employees as follows:

EmployeeName	String	25 chars
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. [15]

2. a) A student is allowed three attempts at a test. The marks from each of the three attempts are input into a program but only the best score (the highest value) is stored.  
Write an algorithm for the routine described above. [5]  
**Note** – you are **not** expected to write the whole program, just the part described here.
- b) Draw a flowchart to describe the following process:  
Two dice are rolled three times  
The face values of the dice are added to an accumulative total  
The process continues until the total reaches a value of 500 or above  
The total is then printed [10]
3. a) Distinguish clearly between a PROCEDURE (or sub-routine) and a FUNCTION. [6]  
b) What are the advantages for the programmer in using procedures and/or functions in a high-level program solution? [5]  
c) Functions may be custom-written by the programmer but there are also many built-in functions in high-level programming languages.  
i Name a programming language and give an example of the syntax of one of its built-in functions.  
ii Explain its purpose for the example given in part i (above). [4]
4. a) Explain why documenting a program is important in a BUSINESS environment. Describe TWO problems that would occur if the documentation was not present or was inadequate. [3]  
b) State SIX sections that would be present in program documentation.  
For EACH, state  
• whether the program user or the maintenance programmer would use it  
and  
• for what purpose [12]
5. a) Dry run the following pseudo-code using the data provided after it. Your answer should be in table form with one column for each variable. Only change values in your table when the pseudo-code instructs you to do so.  
Input (B)  
Input (T) .....X, Y or Z  
C ← 0  
While T ≠ "Z"  
    Input (A)  
    C ← C + 1  
    If T = "Y" then  
        B ← B + A  
    else If T = "X" then  
        B ← B – A  
    Endif  
    Output (T, A, B) to printer  
    Input (T) .....next record  
Endwhile  
Output (B, C)  
DATA: 100, X, 20, Y, 50, X, 5, X, 30, X, 90, Z [11]  
b) List the output to the printer from this data assuming each separate "Output" statement PRINTS ON A NEW LINE. [4]
6. a) Describe the purpose of a **data** file. [3]  
b) Name a **type** of program that would use data files and describe how the program would access the data files. [4]  
c) For the example given in part b) above describe the structure and possible contents of ONE of the data files. [8]
7. The following are programming constructs:  
• Sequence  
• Selection  
• Iteration  
a) Write brief descriptions to explain the purpose of EACH one. [6]  
b) Write an example snippet of code to illustrate EACH one. [9]

8. a) High-level programming languages may be compiled or interpreted. [8]  
i List the main differences between a compiler and an interpreter. [2]  
ii Name ONE compiled language and ONE interpreted language. [5]  
b) Outline and describe the main stages of compilation.