



SEPTEMBER 2015

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 a program routine to display the tax payable by every employee. For each employee, the input data will be employee number and annual salary. A single ZERO is used to terminate the program. The earnings table below shows how tax is calculated:

Salary (£)	Tax rate (%)
1-5,000	0
Next 2,000	20
Any above 7,000	30

Some employees will earn pay which comes into all three categories. Low earners may not pay any tax at all. For example – if a person earns £8,500 – the first £5,000 will not incur any tax, £2,000 will be taxed at 20% and £1,500 will be taxed at 30%.

When all data has been entered and calculated, display EACH employee number and the final amount of their salary (with tax deducted). [10]

- b) A SEQUENTIAL file (called RESULTS) already exists and contains details of all examination results. The file is in ascending sequence of student number. Each record holds details of the results in one subject only so that if a student has taken several examinations, there will be several successive records for that student. Record format is:

Student number integer 4 digits
Subject number integer 2 digits
Percentage mark integer 3 digits

Write a program routine to read the whole file and print out a list, ONE STUDENT PER LINE, showing student number, the count of how many papers were sat and the mean average mark over all those papers. A typical line of the list might be:

2222 5 53.2

This shows that student 2222 has taken 5 subjects in which the average mark was 53.2%. [12]

- c) A program has the following specifications:
- Integer array *intAcNum* is dimensioned from position 1 to 100 and contains Account Numbers consecutively starting at position 1) which represent the identification numbers of customers. After the last used element of the array is a zero
 - In real array *dblBalance* in corresponding positions are the outstanding balances owed by each customer
 - In a variable called *intCustNum* is a customer number
- A routine is required to search the *intAcNum* array for this customer and display the corresponding balance. If the customer number is not in the array, a suitable message should be output instead. [10]
- d) Variable P contains an integer. Write the code which will assign a value to variable Q according to the value of P and given by the following table: [8]

P	Q
odd numbers 1 to 9	3
6, 8 or 10	2
2 or 4	1
0	0
negative number or number greater than 10	-1

2. Devise an algorithm (pseudocode or flowchart) to determine the square root of a number. The following method MUST be used:
- Input the number to be square rooted (N) and also an approximate guess (G)
 - Repeat the process given below until an answer correct to 3 decimal places is determined
 - Output the answer
- PROCESS: Suppose N = 10 and G = 3.
- Divide N by G $\rightarrow 10 / 3 = 3.333$. The exact value of the square root must be between 3 and 3.333
 - Take the mean of these two numbers. $(3 + 3.333) / 2 = 6.333 / 2 = 3.167$ - a better value
 - Now repeat this process with the last two values 3.333 and 3.167 to obtain an even better answer
 - Continue this process until the two answers differ by less than 0.001. The last answer is then output [15]
3. a) Explain why there is a need for data files. [3]
 b) Draw a labelled SYSTEM diagram to show how an UNSORTED transaction file can be used to update a SEQUENTIAL master file. [6]
 c) Naming a particular programming language, state SIX commands associated with FILE programming and, for EACH, state clearly what it achieves. [6]
4. a) A particular screen display is to contain only numeric and text data. Briefly describe FIVE ways in which the programmer can make the output clearer for the user. [5]
 b) An accountant at a college is trying to decide which of the current courses should be continued and which should not. He has a file with the following data for each course. To help the college cost its courses, data has been collected on a file for each of 200 possible courses. All this data is now to be printed so that the Director of Studies can compare figures. Data held for each course is:
- | | | |
|-------------------|----|-------------------------|
| course name | 25 | character |
| course code | 4 | integer |
| total cost to run | 8 | real |
| length of course | 2 | integer (in weeks) |
| total course time | 2 | digits (hours per week) |
| number students | 2 | integer |
- Design a print layout showing all headings and using a full sheet of paper to display the details of ALL the 200 courses so that they may be compared. You should fill in details for TWO courses. [10]
5. a) Explain the term **function** used in high-level programming and how it is used. Give an example of a standard function available in a particular high-level language, explaining what that particular function achieves. [5]
 b) Define the term **procedure** and explain how it differs from function. [4]
 c) Define the terms **local** and **global variable**, giving examples of their use. [6]

6. a) Explain clearly the THREE different terms below:
i Testing plan [6]
ii Test data [3]
iii Testing log [6]
- b) Describe the differences between Black box and White box testing. [3]
- c) Program testing is a crucial part of software development and in a large company several people might be called upon to test a program at various stages. Name THREE people who might be involved in testing a program and specify at what stage EACH will carry out their testing. [6]
7. a) Describe what is meant by **TOP-DOWN** design in programming. [2]
- b) Give one advantage of a top-down approach to EACH of the following:
i Program developer
ii Maintenance programmer
iii Program user [3]
- c) List THREE elements of program documentation which are particularly useful to the end user, giving a reason for EACH. [6]
- d) State TWO elements of documentation which are particularly relevant to an end user. [4]
8. a) List the differences between compilation and assembly. [6]
- b) Outline the differences between an OBJECT-ORIENTED language and a PROCEDURAL language. Name a language for EACH. [9]