

GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD
General Certificate of Education Examination

JUNE 2021

ADVANCED LEVEL

Subject Title	Computer Science
Paper No.	3 – Practical
Subject Code No.	0795

Two Hours

Carry out ALL the tasks given. For your guidance, the approximate mark for each part of a task is indicated in brackets.

Great importance is attached to the accuracy, layout and labelling of drawings and computer generated outputs.

You are reminded of the necessity for good English and orderly presentation of your answers.

Write algorithms in the answer booklet provided. Also record in your answer booklet any information requested or that you believe would make it easier to understand how you carried out tasks or answered questions.

You are expected to print out a single copy of relevant fragments of your program at different times. Please notify the instructor of any required printout that was not done!

When an imperative programming language is required to write program code, either **Standard [ISO] Pascal** or the **[ANSI] C or C11** programming languages may be used.

If need be, supervisors will assist you in recording details of intermediate work carried out on the computer.

Do not write on the first page of your answer booklet. It is reserved for administrative purposes.

Where information is provided as soft copy, notify the instructors if it is not found in your machine or has not been made available to you.

Turn Over

SECTION A (Programming)

Binomial expansions are sometimes aided by a tool known as the Pascal triangle. Pascal's triangle is an array of numbers which is triangular in nature. An example is shown in Figure 1 below:

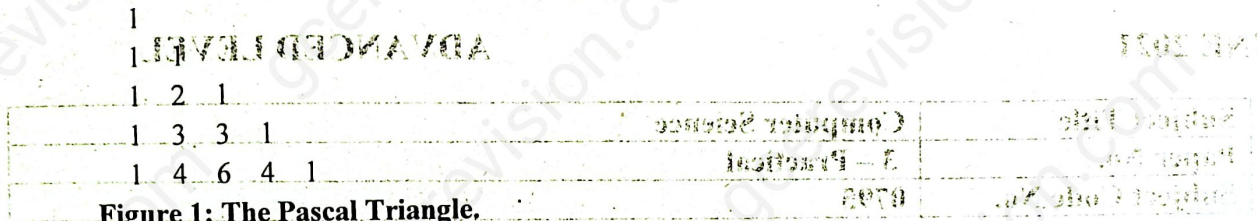


Figure 1: The Pascal Triangle.

Here we realise that it is an $N \times N$ matrix where N is a natural number. The leading diagonal of the matrix and the first column are made of 1's only.

That is, if the matrix is A , then all $A[i, 1]$ are 1's and all $A[i, i]$ are 1's for each line (row) i of the Pascal Triangle. Elements of each line run from $A[i, 1]$ to $A[i, i]$ but $A[i, 1]$ and $A[i, i]$ are 1's, and can be filled in advance.

To fill each cell $A[i, j]$ within the rest of the triangle, we go from $A[i, 2]$ to $A[i, i-1]$, with j ranging from 2 to $i-1$. So, every $A[i, j] = A[i-1, j] + A[i-1, j-1]$.

TASK 1 (11 Marks)

Do the following in your answer booklet.

- With the above in mind copy the Pascal triangle in Figure 1 in your answer booklet. Attach to it the next TWO lines of the Pascal triangle. (2 marks)
- Write an algorithm to fill the leading diagonal of a Pascal triangular matrix A (n rows and n columns). (2 marks)
- Write another algorithm in your answer booklet to fill the first column of your Pascal triangle. It then fills the remaining columns of the matrix A with zeros. (3 marks)
- Write yet another algorithm to fill the rest of the row, apart from the first and the last element of Pascal's triangle. Entries beyond the diagonal elements are filled with zeros. (4 marks)

TASK 2 (17 Marks)

- Transform the algorithms from Task 1 into programming language (PL) functions or procedures. (9 marks)
- Write a PL function or procedure that prints all the elements of an $N \times N$ matrix. (3 marks)
- Write the main program that calls the procedures from (a) and (b) above in their right order so as to populate and print elements of the matrix. Make sure your program works correctly. (3 marks)
- Save then print out your program code. (1 mark)
- Save the output of your program and then print it. (1 mark)

SECTION B (Databases)

The database system of a company has a table PC for details of its personal computers, and a table Employee for details of its employees, with attribute names of obvious meanings. No attribute entry in table PC is unique. However, in table Employee, the entries of EmpNo (for employee number) and UserID are unique to each employee. Table Employee also contains details that indicate the type of personal computer(s) each employee uses. Sample entries for the tables are the following

PC type	Processor	RAM (GB)	Disk Size (TB)
HP	Core i5	8	1
HP	Core i7	16	4
Lenovo	Dual Core	8	1

First Name	Last Name	UserID	EmpNo	PC type	Processor
Joe	Bloggs	jbloggs	25	HP	Core i7
Mary	Smith	msmith	80	Lenovo	Dual Core

TASK 3 (12 Marks)

- In your answer booklet, write down the SQL data types you will use to implement your tables described above. **(5 marks)**
- Using your favourite database management system (DBMS), create the tables indicated above. **(4 marks)**
- For each table, add two rows of data consistent with the expected column entries. They should not be copies or permutations of the sample entries given. Save the tables in your database. **(2 marks)**
- Print out a copy of the content of your table. Save a copy in a text file. **(1 mark)**

TASK 4 (10 Marks)

- Table Employee is not normalised because it has non-key details of table PC. Your favourite database management system (DBMS), create the tables indicated above. Add to table PC an attribute that could be used as a primary key. In your answer booklet, state what you did. **(3 marks)**
- In your answer booklet, create the relation called E_PC that associates each employee with one or more machines. Clearly identify the key of this relation. **(2 marks)**
- Given relation E_PC, modify relations PC and Employee within your DBMS so that they are better normalised. That is, so that they are at least in 2ND or 3RD normal form. Save your tables. **(4 marks)**
- Print out a copy of the content of your table. Save a copy in a text file. **(1 mark)**

END