# GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

## 0795 Computer Science 3

**JUNE 2023** **ADVANCED LEVEL**

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|---|---|
| **Subject Title** | **Computer Science** |
| **Paper No.** | **Paper 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.

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

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

## SECTION A: A Plotting Program (Program Development) (30 Marks)

**Describing the Task.**

Many interesting programming problems involving nested loops can be encountered when creating plots using a printer. Your task is to create the plot in Figure 1 (pyramid) in a general manner with the size of the base entered at the beginning of program execution. Arrays are not used to do this. (The grid lines are just to ease working with the figure; the lines are not directly needed to answer any question.) A pyramid has a number of stars at its base (MaxNoOfStars), and is made up of rows of spaces and stars. Each line of the pyramid is made up of an odd number of leading spaces (NoOfSpaces) followed by a number of stars (NoOfStars). There are blanks after the stars, but they are not important for this exercise.

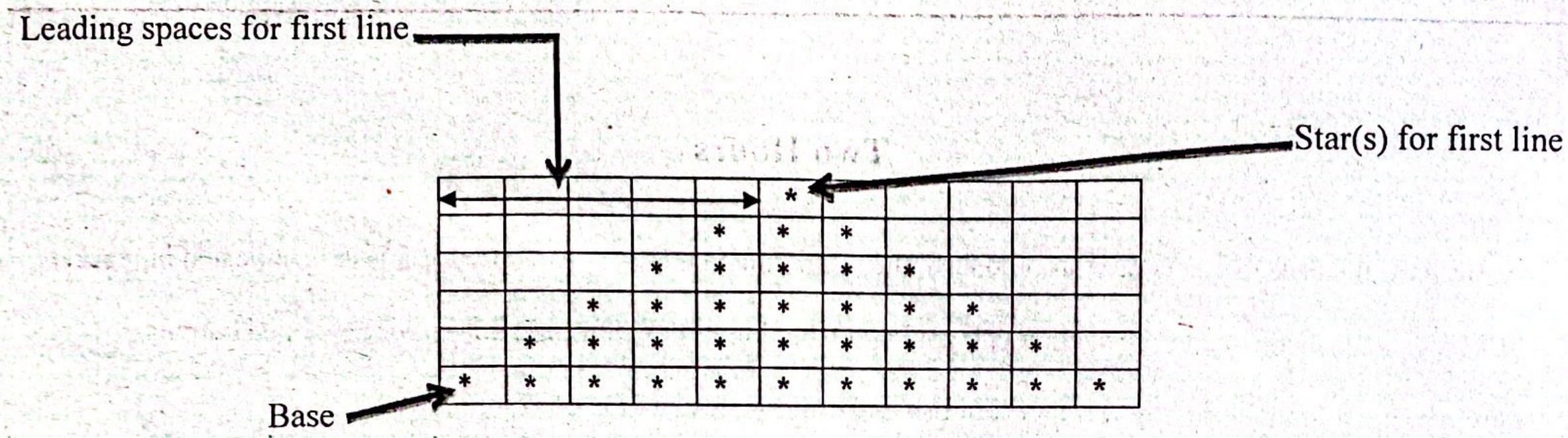


**Figure 1. Pyramid of Stars**

**Task 1: Problem Understanding** **(8 marks)**

1. A solution to this problem is outlined in the following algorithm:

*Initialise number of spaces and stars*
*Repeat*
*For the current line:*
*Output leading spaces*
*Output line of stars.*
*Adjust number of spaces and stars for the next line*
*Until number of stars is the number required*

Mindful of the Task description above, consider the pyramid of stars in Figure 1 above and carry out the following:

(i) State the initial values for MaxNoOfStars. **(1 mark)**

(ii) State the number of leading spaces (NoOfSpaces) and stars (NoOfStars) of the first line. **(2 marks)**

(iii) State the number of leading space (NoOfSpaces) and stars (NoOfStars) for the second line. **(2 marks)**

(iv) Between successive lines, the number of stars reduces while the number of leading spaces increases. Hence, by what amounts should you modify NoOfSpaces and NoOfStars before printing the next line in the Pyramid, if we print successive rows from the top of the pyramid? **(3 marks)**

**Task 2: Program Development** **(12 marks)**

Choose EITHER the Pascal OR the C programming language (PL) to implement your plot of the pyramid of stars.

2. Using a suitable editor of your choice, write the following functions and/or procedures.

(i) The procedure ***Initialise (MaxNoOfStars, NoOfSpaces, NoOfStars)*** to initialise the variables ***MaxNoOfStars***, ***NoOfSpaces*** and ***NoOfStars*** for the first line. **(2 marks)**

(ii) The procedure ***OutputLeadingSpaces (nSpaces)*** which takes the number ***nSpaces*** and outputs that number of leading spaces for a line on the screen. **(2 marks)**

(iii) The procedure ***OutputLineOfStars (nStars)*** which takes the number ***nStars*** and outputs that number of stars for a line on the screen. **(2 marks)**

(iv) The procedure ***Adjust (NoOfSpaces, NoOfStars)*** adjusts the variables ***NoOfSpaces*** and ***NoOfStars*** to the values used to print the next row of blanks and stars. **(2 marks)**

3. Develop the algorithm given as pseudocode in Task 1 (1) as a main program that calls the procedures (or functions) you implemented in Task 2 (2). For it, the NoOfSpaces, NoOfStars and MaxNoOfStars, presented under Task Description are stored in global variables. [***Hint:*** *The condition* "number of stars is the number required" *in the algorithm could be coded as* "NoOfStars > MaxNoOfStars".] **(4 marks)**

**Task 3: Executing Your Program** **(4 marks)**

4. (i) Run your program for a pyramid of base 9, and test it to make sure that it works correctly. Screenshot the output and save it in a file named task3. Print the screenshot. **(3 marks)**

(ii) Print a copy of your PROGRAM SOURCE CODE and attach it in your answer booklet **(1 mark)**

**Task 4: Modifying Your Program** **(6 marks)**

5. (i) Modify your program so that it asks the user to enter an odd positive integer, and then it displays a diamond of stars based on that number. For example, the value 7 would produce: **(4 marks)**

```
        *
      * * *
    * * * * *
  * * * * * * *
    * * * * *
      * * *
        *
```

(i) Run your program for a pyramid of base 7, and test it to make sure that it works correctly. Screenshot the output of your program and save it in the file named task3. Also print the screenshot. **(1 mark)**

(ii) Print a copy of your PROGRAM SOURCE CODE and attach it in your answer booklet. **(1 mark)**

**SECTION B: School Trip (Databases)** **(20 marks)**

**Task 5: School Trips** **(20 marks)**

A school keeps records of school trips, teachers who supervise these trips and pupil who attend trips in a database in a way that will allow information about these details to be extracted. The data requirements are defined as follows:

- Each trip is assigned a trip id (unique), start date, end date and destination.
- Each teacher has a teacher id (unique), a tittle, first name and surname.
- Each pupil has an id (unique), first name, and a surname.
- Each pupil may attend more than one trip.

- A trip can be attended by more than one pupil.
- Each trip is supervised by only one teacher at any given time.
- A teacher can supervise more than one trip.

The relational database has four tables **TEACHER , TRIP, PUPIL, PUPILTRIP** whose meaning are obvious, with attributes (primary key is underlined) as follows:

**TEACHER**(TeacherID, Title, FirstName, Surname)
**TRIP**(TripID, StartDate, EndDate, Destination, TeacherID)
**PUPIL**(PupilID, PupilSurname, PupilFirstName)
**PUPILTRIP**(PupilID, TripID)

(i) In your answer booklet, draw an Entity-Relationship diagram that shows entities, relationships and the degree of each relationship for the school trip database. **(3 marks)**

[**Note:** *for the following subtasks, first write in your answer booklet the SQL queries (or statements) used to implement its activities in your DBMS*]

(ii) Using SQL statements, do the following using your favourite database management system (DBMS)
(a) Create a database called TripsDB. **(1 mark)**
(b) In TripsDB, create all the relations given above. **(4 marks)**

(iii) Using the SQL insert command,
(a) populate the **TEACHER** relation with the following 3 rows of data

| TEACHERID | TITLE | FIRSTNAME | SURNAME |
|---|---|---|---|
| T1 | Mr. | John | Book |
| T2 | Mrs. | Mbong | Ngum |
| T3 | Mr. | Aminde | Tom |

**(2 marks)**

(b) populate the **TRIP** relation of your database with 3-5 rows of trip data. The data for each trip should be consistent with data for the **TEACHER** relation. **(2 marks)**

(c) populate the **PUPIL** relation with the following data

| PupilID | PupilFIRSTNAME | PupilSURNAME |
|---|---|---|
| P001 | Neba | Ngu |
| P002 | Samira | Bih |
| P003 | Amina | Abu |

**(2 marks)**

(d) populate the relation **PUPILTRIP** such that its data is consistent with the relations **PUPIL** and **TRIP** relation. **(2 marks)**

(iv) Using SQL commands, write an SQL statement to query the database tables for each of the following:

(a) The TripID, StartDate, EndDate and Destination of all trips surpevised by the teacher with teacher id T1. **(2 marks)**
(b) The TripID and the name of pupil who attended a trip surpevised by the teacher with teacher if T1. **(2 marks)**

***NB:*** *You must print to show proof of the work done in (i), (ii), (iii) and (iv) above.*