Arithmetic Calculator

Course Project

Problem Solving and Programming
Department of Engineering Sciences and Humanities
Vishwakarma Institute of Technology
Pune, India

Group Members	**GR Number**	**Our Guide**
Kaivalya Aole (Leader)	12011351	Prof. Pinki Agarwal
Archis Khuspe	12010147	
Anway Chaware	12010881	
Sharv Apte	12011006	
Vhanneshwar Arawat	12011411	

Area Study

A calculator, for us, is a self-contained, robust, simple to use software device which supports working in some area analogous to the way the familiar, hand-held, electronic calculator helps working in arithmetic. The traditional calculator supports the users in arithmetic tasks by relieving them of the burden of carrying out the arithmetic operations, allowing them to concentrate on the substance of the problem at hand. An important design feature of a calculator should be that it can be used without a great deal of explanation and instruction.

Problem Statement

Developing an algorithm for a calculator using C programming to make an interface to give input and return with the output. The abstract design is the layout for the calculator. Using the C program, the calculator should perform elementary as well as advanced functions.

Definition of the Problem Statement

In the project, we had a simple hypothesis, providing calculators for students who would improve their performance on formal reasoning courses, which they typically find arduous. This project's scope was to design a fully functioning calculator that would calculate various mathematical concepts.

This design used several components covered during the lab portion of class like if-else, switch case, loop, etc. The motivation for this aspect is its importance and usage in real-life applications, such as in various branches of science and in everyday lives.

Literature Survey

Calculators allow students to solve complicated problems quickly and in an efficient manner. It can reduce the pain to more straightforward tasks and enable the student to devote more time to understanding the problem. Secondly, they are saved from tedious calculations and the same tiresome, mundane procedure.

The above advantages help students to avoid boredom, and it does not demoralize their mathematical understanding. If mathematics is not made entertaining, pupils can feel bored, demoralizing their mathematical knowledge.

Calculators help out a lot to those whose mathematical capacity is unsubstantial. Using this device helps them manage their

mathematical problems in no time. They would make fewer mistakes and will be more comfortable in solving challenging problems. If a student is confident about his or her ability, then the problem seems halfway solved.

Most calculators are very diverse in functionality. There are various types of calculators used in a variety of fields. Some of them are:

- Arithmetic Calculators
- Basic Calculators
- Scientific Calculators
- Abacus Calculators
- Finance Calculators
- Graphing Calculators

The calculator on which the project is based is the Arithmetic Calculator. Arithmetic is a branch of mathematics that consists of studying numbers, especially the traditional operations' properties.

The calculator has been programmed with functions belonging to the elementary part of number theory, such as geometry, data analysis (statistics), mensuration, and core operations like addition, multiplication, etc.

Introduction

Calculators are for performing calculations from basic arithmetic to complex mathematics. In our course project, the calculator calculates statistical and mathematical problems using the 'C' language. The project is a user-friendly C program to calculate areas and volumes of 2D, 3D shapes and summations of series and statistics in no time.

In this program, we have used if-else benefit, switch-case statements, break statements, and 'for' loops to calculate the problem. The user has to select the function he wants to execute and enter the measurements, and then the program will then quickly calculate the answer.

Specify Modules (Features)

The arithmetic calculator encompasses the following function codes:

Area of 2D shapes

- Circle
- Rectangle
- Triangle
- Square
- Parallelogram
- Rhombus
- Trapezium

Area and volume of 3D shapes

- Cube
- Cuboid
- Cylinder
- Cone
- Sphere
- Hemisphere
- Hexagonal Prism
- Tetrahedron

Summation of series

- Sum of all 'N' natural numbers
- Sum of all '1/N' natural numbers
- Sum of the square of all the natural numbers from 1 to N
- Sum of the cube of all the natural numbers from 1 to N
- Sum of all odd numbers from 1 to N
- Sum of all even numbers from 2 to 2N
- Sum of Natural Number/Factorial of Number of all the natural numbers from 1 to N

Statistics

- Mean
- Variance
- Standard Deviation

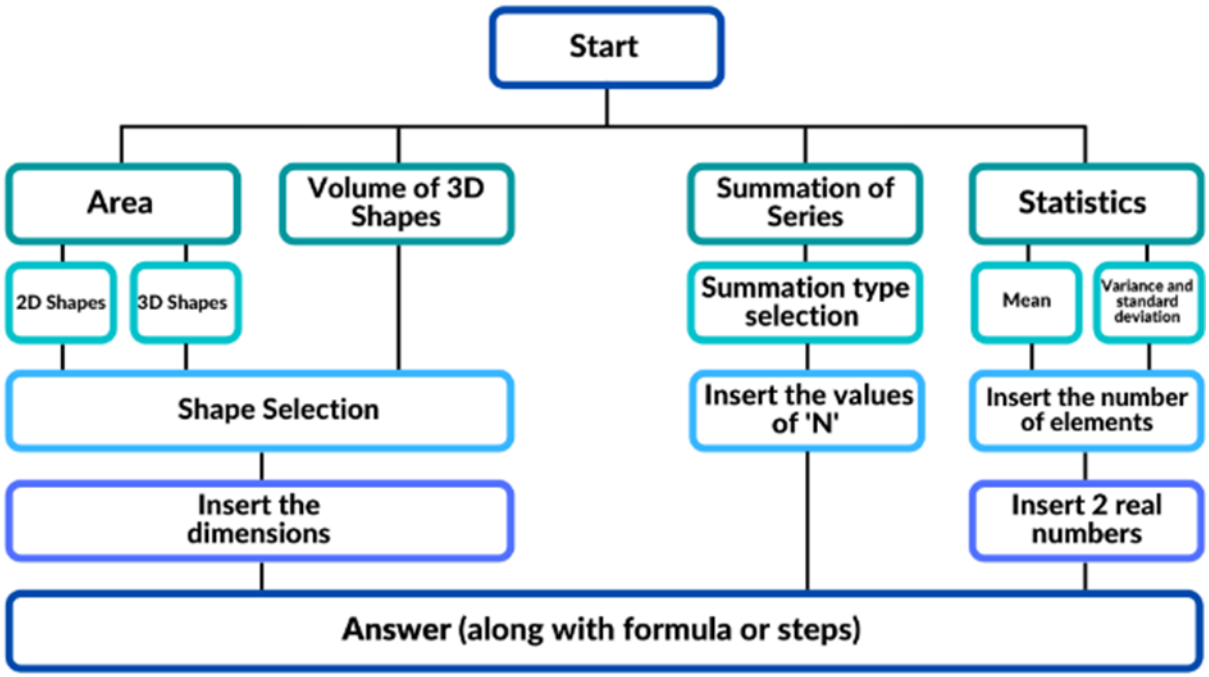
Description of Project workflow

First, the user will be asked for the required function code, which contains the respective functions. These functions are:

- Area of 2D shapes
- Area of 3D shapes
- Volume of 3D shapes
- Summation of various series
- Statistics

The user will then be asked for the figure code, including different geometric shapes, to find the area and volume, summation of various series, mean, variance, and standard deviation. After selecting the respective function and figure code, the user will be requested for the input values, and the solution will be provided as an output.

System Architecture/Block Diagram



Algorithm

Step 1: Start

Step 2: Set variable function code, print various printf statements, and scan the user's figure code.

Step 3: If (function code = 1)

Declaring variables fig_code, side, base, base1, base2, length, breadth, height, area, radius, altitude, diagonal1, diagonal2, surface_area; printing names of 2D shapes of which the area is to be found and scanning fig_code.

Switch(fig_code)

Case 1: Area of circle

Case 2: Area of Rectangle

Case 3: Area of Triangle

Case 4: Area of Square

Case 5: Area of Parallelogram

Case 6: Area of Rhombus

Case 7: Area of Trapezium

Default: Error in figure code

Else if (function code = 2)

Declaring variables fig_code, side, length, breadth, width, radius, height, base_edge, surface_area; printing name of 3D shapes of which area is to be found and scanning fig_code.

Switch(fig_code)

Case 1: Area of Cube

Case 2: Area of Cuboid

Case 3: Area of Cylinder

Case 4: Area of Cone

Case 5: Area of Sphere

Case 6: Area of Hemisphere

Case 7: Area of Hexagonal Prism

Case 8: Area of Tetrahedron

Default: Error in figure code

Else if (function code = 3)

Declaring variables fig_code, side, length, breadth, width, radius, height, base_edge, volume; printing names of shapes of which volume is to be found and scanning fig_code.

Switch(fig_code)

Case 1: Area of circle

Case 2: Area of Rectangle

Case 3: Area of Triangle

Case 4: Area of Square

Case 5: Area of Parallelogram

Case 6: Area of Rhombus

Case 7: Area of Trapezium

Default: Error in figure code

Else if (function code = 4)

Declaring variables fig_code, n, sum=0, i, Nth, number, j, total, sum, numbers; printing various types of series of which summation is supposed to be found and scanning fig_code.

Switch(fig_code)

Case 1: Sum of all 'N' natural numbers

Case 2: Sum of all '1/N' natural numbers

Case 3: Sum of the square of all-natural numbers from 1 to N

Case 4: Sum of the cube of all-natural numbers from 1 to N

Case 5: Sum of all odd numbers from 1 to N

Case 6: Sum of all even numbers from 2 to 2N

Case 7: Sum of Natural Number/Factorial of Number of all-natural numbers from 1 to N

Default: Error in figure code

Else

Declaring variables fig_code, MAXSIZE=100, x[MAXSIZE], i, n, mean, variance, std_deviation, sum = 0, sum1 = 0; printing various statistics functions and scanning fig_code.

Switch(fig_code)

Case 1: Mean

Case 2: Variances and Standard Deviation

Default: Error in figure code

Step 4: Return 0.

Pseudocode

```
If the function code = 1
    Switch(fig_code)
        Input for fig_code
            Area of 2D shape
                Input as dimension to find the area of the selected figure.

Else If the function code = 2
    Switch(fig_code)
        Input for fig_code
            Area of 3D shape
                Input as dimension to find the area of the selected figure.

Else If the function code = 3
    Switch(fig_code)
        Input for fig_code
            Volume of 2D shape
                Input as dimension to find the volume of the selected figure.
```

Else If the function code = 4

Switch(fig_code)

Input for fig_code

Summation of series

Input as a natural number to find the summation of the selected figure.

Else

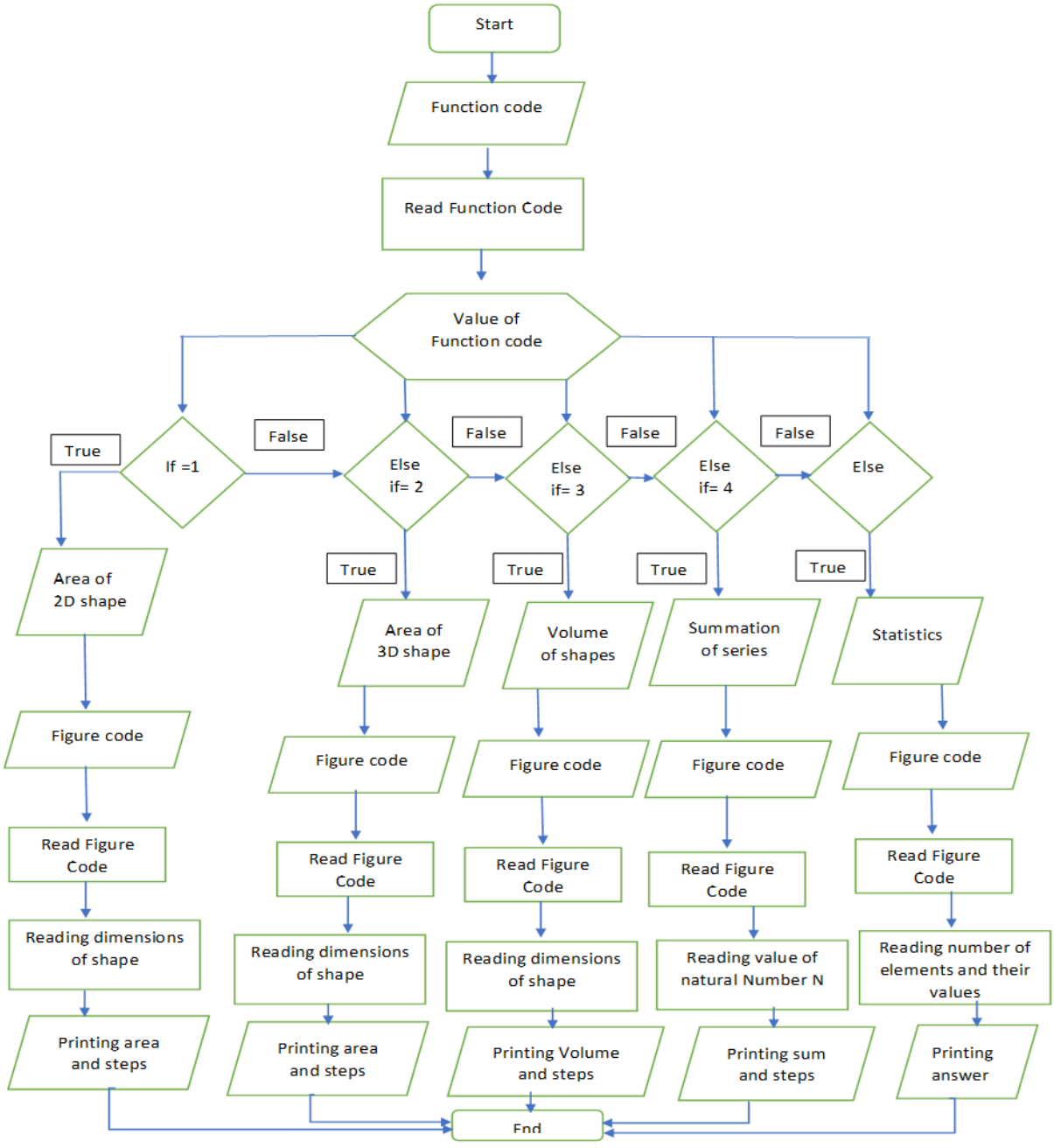
Switch(fig_code)

Input for fig_code

Statistics

Input as a number to find mean, Variances, Standard Deviation.

Flowchart



Project Implementation in C

Data class is the container class used in the program. In this class, the libraries used are:

- #incliude <stdio.h.>
- #include<math.h>

Calculator class is the backbone of this program. It includes the functions which are essential for obtaining the calculations using the respective formula. The functions implemented are:

- double
- int
- char
- switch
- case
- printf
- if, else

Results

With the help of this project, we can calculate the answer to the user's problem statement. For example, the user can get the area of a 2D shape by selecting the related category of the problem statement).

The solution to the summation problems would be step-wise, i.e., all the essential steps would be mentioned with the final answer.

The solution to the area and volumetric problems would be up to 3 decimal points, with the steps and formula used.

The solution to the statistical problems would also be step-wise, with them having the answer up to 2 decimal points with the formula used (in the case of mean) and the required steps.

Conclusion

In this project, we have developed a calculator for mathematical and statistical problems. We began by defining five different cases of problem statements. The user has to select the intended case before statements. The user selects the intended case; he/she has to enter the values of expected parameters. After providing the desired inputs program will return relative output.

This project aims to help out many of those whose mathematical problem-solving capacity is weak; apart from studies, we can use this project in key household problems, such as calculating the area of ceiling and walls for painting purposes.

Our goal is to solve problems with fewer efforts and time. With the help of this calculator, complex problem solving will be very easy. This project will help to reduce the time of calculation. We hope that the students would benefit significantly from using this project for their studies and guide many others in need. We thank everyone who helped us and enabled us to grow and develop with this project.

The solution to the summation problems would be step-wise, i.e., all the essential steps would be mentioned with the final answer. For area and volumetric problems, it would be up to 3 decimal points, with the steps and formula used. And for statistical problems, it would also be step-wise, having the answer up to 2 decimal points with the formula used (in the case of mean) and the required steps