CSE102 – Computer Programming [redacted]

Homework #5

[redacted]

Hand-in Policy: Via Teams. No late submissions will be accepted. Files named main.c and makefile for this homework and compress it into a StudentNumber_Name_Surname.zip file. For your questions, you can write under the assignment post in the Teams application.
Collaboration Policy: No collaboration is permitted.
Grading: This homework will be graded on the scale of 100.

Homework Description: Write a complete program that performs geometric calculations. All the requirements requested from you must be fulfilled. In this homework you have to create a calculator that calculates the area, perimeter, and volume values of various shapes. You must have 2 enumerated types. You have to call these enumerated types ***shapes*** and ***calculators***.

Shapes must have;
Triangle,
Quadrilateral,
Circle,
Pyramid,
Cylinder

Calculators must have;
Area
Perimeter
Volume

You must use these enumerated types in all subsequent operations and selections. Except for the Main function, the following 3 functions have to be.

Function prototypes are :

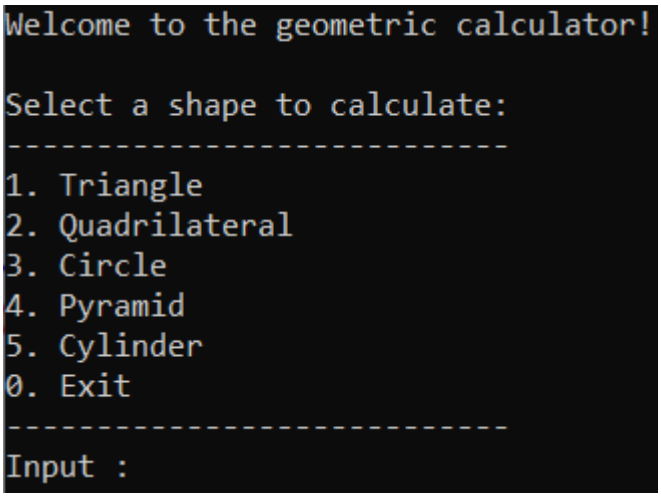
int select_shape ()

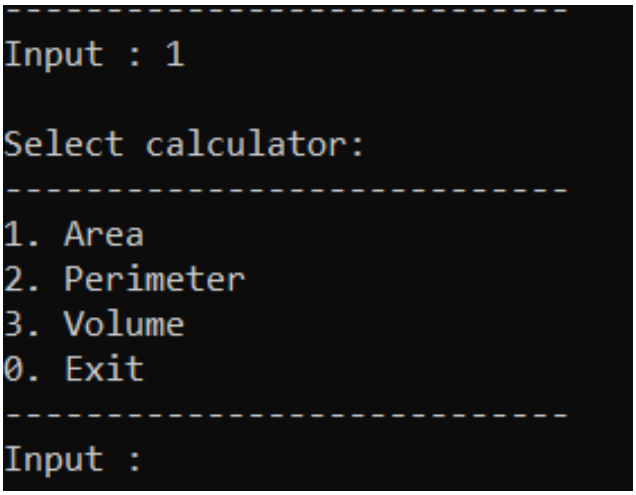
int select_calc ()

int calculate (int (), int ())

The calculate function has to take select_shape() and select_calc() functions as parameters. This calculate function has to be called inside the main function and the program will continue to run unless the user sends an exit command. First, the user must select the shape, then choose the area, perimeter or volume to calculate it. A character or negative value cannot be entered. All incorrect entries in the program should be checked. Wherever in the program or selection, if the user enters input incorrectly, the program should handle this situation and issue a warning message then the program flow should continue. The program must not be interrupted by any wrong input.

Expected Menu Output





You have to use the switch-case structure in the calculate function. You must assume and define the PI value as 3.14. For each shape, you should write a calculation function that takes the enum type of the value to be calculated (area, volume, or perimeter) as a parameter.

Function prototypes are:

```
int calc_triangle(int);

int calc_quadrilateral(int);

int calc_circle(int);

int calc_pyramid(int);

int calc_cylinder(int);
```

In all calculation functions, you have to create the sections where the area, volume or perimeter values are calculated by using the switch-case structure. You have to use Heron's formula when calculating the area of a triangle, and Brahmagupta's formula when calculating the area of a quadrilateral.

Formulas:

TRİANGLE

$$\boldsymbol{Heron's\ Formula} = \sqrt{s * (s-a) * (s-b) * (s-c)}$$

$$s = \frac{a+b+c}{2}$$

Important: In any triangle, sum of any two sides of is always greater than the third side. Hence in any triangle, the semi perimeter can not be less than any side. You have to check this situation in the program. Since the volume cannot be calculated for Triangles and Quadrilaterals, you should give a warning and continue the program.

```
Welcome to the geometric calculator!

Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 1

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 1

Please enter three sides of Triangle :
3
4
5

Area of TRIANGLE : 6.00
```

```
----------------------------
Input : 1

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 1

Please enter three sides of Triangle :
a

ERROR ! Please enter a valid entry.

0
s

ERROR ! Please enter a valid entry.

1
3
66

ERROR ! Please enter a valid triangle.
```

```
Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 3

ERROR ! You cannot calculate the volume of a triangle. Please try again.

Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 1

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 2

Please enter three sides of Triangle :
3
-7
5

ERROR ! Please enter a valid entry.

5
6
7

Perimeter of TRIANGLE : 18.00
```

QUADRILATERAL

$$Brahmagupta's\ Formula = \sqrt{(s-a)*(s-b)*(s-c)*(s-d)}$$

$$s = \frac{a+b+c+d}{2}$$

```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 2

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 1

Please enter four sides of Quadrilateral
3
5
7
9

Area of QUADRILATERAL : 30.74
```

```
Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 3

ERROR ! You cannot calculate the volume of a quadrilateral. Please try again.

Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 2

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 2

Please enter four sides of Quadrilateral
a

ERROR ! Please enter a valid entry.

5
-6
fg

ERROR ! Please enter a valid entry.
```

CIRCLE

$$Circumference = 2 * \pi * r$$

$$Area = \pi * r^2$$

```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 3

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 1

Please enter the radius of Circle :
6

Area of CIRCLE : 113.04
```

```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 3

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 3

ERROR ! You cannot calculate the volume of a Circle. Please try again.
```

PYRAMID

$$Volume = \frac{1}{3} * a^2 * h$$

$$Base\ Surface\ Area = B = a^2$$

$$Lateral\ Surface\ Area = L = 2 * a * l$$

$$Surface\ Area = B + L$$

```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 4

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 3

Please enter the base side and height of a Pyramid :
6
10

Volume of a PYRAMID : 120.00
```

```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 4

Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 1

Please enter the base side and slant height of a Pyramid :
6
8

Base Surface Area of a PYRAMID : 36.00

Lateral Surface Area of a PYRAMID : 96.00

Surface Area of a PYRAMID : 132.00
```

CYLINDER

$$Volume = \pi * r^2 * h$$

$$Base\ Surface\ Area = \pi * r^2$$

$$Lateral\ Surface\ Area = 2 * \pi * r * h$$

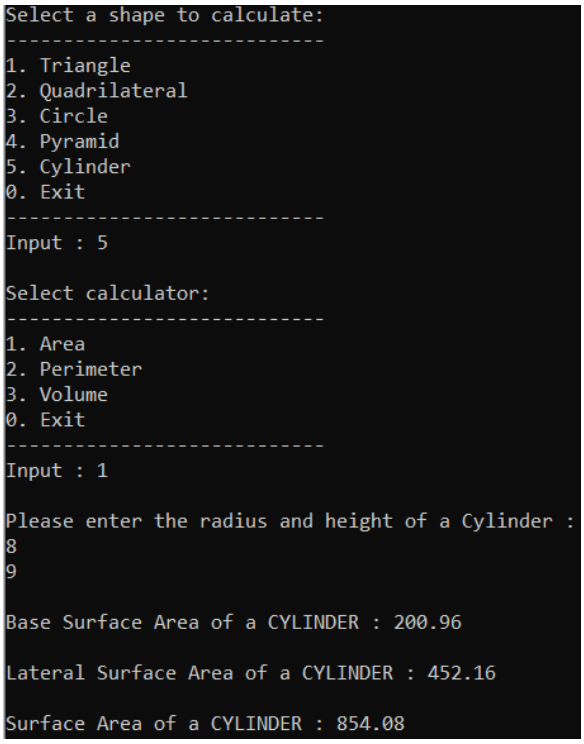
$$Surface\ Area = 2 * \pi * r * (r + h)$$

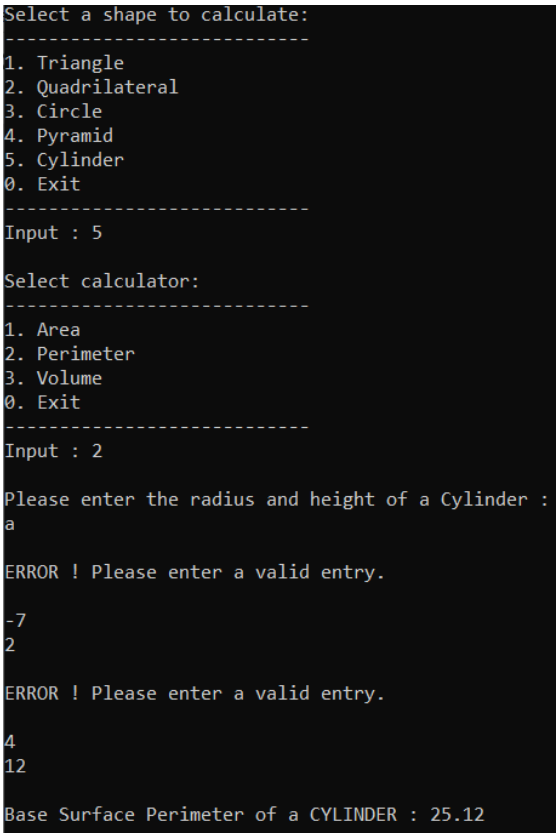
```
Select a shape to calculate:
----------------------------
1. Triangle
2. Quadrilateral
3. Circle
4. Pyramid
5. Cylinder
0. Exit
----------------------------
Input : 5
```

```
Select calculator:
----------------------------
1. Area
2. Perimeter
3. Volume
0. Exit
----------------------------
Input : 3

Please enter the radius and height of a Cylinder :
5
12

Volume of a CYLINDER : 942.00
```





Not all states are shown in the expected outputs, but you have to check all states and incorrect entries for each calculation. You must also perform the calculations that are not shown exactly. The important formulas are all given, you have to look for the necessary formulas for the calculation. You cannot use Arrays. You cannot use Recursion. You can use fflush(stdin) if you are getting a character error while getting input from the user. You can only use "math.h", "stdlib.h" and "stdio.h" libraries.

General Rules:

1. Obey the style guidelines.
2. Do not change the provided function prototypes (you will not get any credits).
3. The program must be developed on Ubuntu using GCC compiler (version provided in class), compilation problems due to the use of another OS or compiler is your responsibility (you will not get any credits).
4. Your program should work as expected. Do not expect partial credit if your code works only in some cases but not in all cases as expected.
5. Hand in your work using the appropriate class Teams assignment site.
6. No late submissions will be accepted.
7. Pack this directory into a zip file named 20180000001_X_Z.zip
8. When unpacked as above in Ubuntu (version provided in class) it should allow executing the following commands in a shell:
   - "$make clean" removes everything except makefile, source code (.c) and other resource files (if any) – all compiling results and intermediate files should be removed (except results.txt).
   - "$make compile" should compile the code.
   - "$make run" should run the code along with any parameters needed.