Student Name: **Weight:** **20%**

Student ID: **Marks:** **/100**

Assignment: Functions, Scoping and Abstraction

Type: Group Assignment

- Students should **ONLY** use programming constructs covered in modules 1, 2 and 3.
- **Submission will not be accepted when using programming concepts that are not covered in modules 1, 2 and 3.**
- **Late submission will not be accepted**
- **If a group member does not submit their demonstration video, that individual will receive a grade of 0 on the group assignment.**

Scenario

The Painter's Company (TPC) is an established small business that wants to become a national business by expanding across Canada. TPC is known for providing high-quality interior painting services at a fair price. The company has developed their reputation by hiring trustworthy, experienced professionals and by providing same-day accurate quotes.

TPC executives have recognized that the company's current quotation process is outdated and relies too heavily on manual calculations. They have requested your help in developing an application to streamline the process.

The application needs to be able to calculate the total interior surface area to be painted, the amount of paint needed, and the total cost of the job, including supplies and labour. The executives remind you that a typical room in a house has four walls, with opposite walls being equal. Typically, rooms are rectangular or square in shape. Some rooms, however, might have fewer than four walls (not all walls will be painted) or more than four (odd shaped rooms). If the ceiling is to be painted, the application will allow the estimator to enter that as an extra wall in the odd shaped room choice.

Equipment and Materials

For this assignment, you will need:

- Python IDE

Instructions

This assignment consists of two sections, both completed outside of class time. See Brightspace for the exact due dates.

Group Submission (95%)

1. Working in a group, review the Scenario and the Program Requirements sections of this document.
2. Write a program that meets the requirements.
3. When your program is complete, use the data listed in the test Plan below to see if your program works correctly.
    a. **Note:** Check your program against the marking criteria for the submission.
4. Only one copy is required per group, and any of the group members may submit the following to Brightspace:
    - The code of the program that you implemented (.py file)
    - A copy of the output from your test runs (.txt file(s))

Individual Submission (5%)

Peer Assessment (1.5%)

Each student must also complete a peer assessment of their group members.

- In the peer assessment, each group member will submit a quiz questionnaire for the other group members (not themselves). Further instructions will be provided by the instructor.

Demonstration Video (3.5%)

Each student will submit a video (no more than 5 minutes long). In the video, the student will:

- introduce themselves and indicate which team they are a part of (i.e. Team number) – camera should be on
- share the group's final solution (code) and explain a part of the code that they developed

Program Requirements

- The application should use functions to ensure the usability of the code.
- **The functions (i.e., name, parameters, return) MUST be exactly implemented as specified**
- When the user opens the application, the program should display a starting message.
- Ask the user to enter the price of the paint to be used in the estimate
- Ask the user to entry the number of coats (applications) required for the job

- Ask the user to input the number of rooms to be painted.
- Be sure to indicate what units are being used for all inputs and outputs.
- Ensure that the application collects information for each room separately, asking for the number and shape of the surfaces to be painted, as well as features such as windows or doors.
    - Ask the customer if the room shape is square (all four walls to be painted), rectangular (all four walls to be painted) or custom.
    - If the user selects rectangular walls, ask them to enter the width, length and height of the room.
    - If the user selects square walls, ask them to enter just one wall dimension and the height of the room.
    - If the user selects custom, ask them for the number of walls and the dimensions of each wall to be painted.
- For all room types, the application should ask the user how many windows and doors the room contains and their dimensions.
- Program outputs must include:
    - For each room: the surface area to be painted, how many gallons of paint are required, and the estimated **total cost** of paint for painting that room.
    - The overall total surface area to be painted in the house, how many gallons of paint are required, and the **total cost** of painting the whole house.

      Note: Total cost includes the cost of labour, materials and a profit margin.
- Program calculations shall be based on:
    - The following constraints:
        - Assume the customer will be painting all rooms with the same paint – if more than one color or type of paint is required, estimator will need to run more than one quote for a customer
        - Paint coverage in square feet per gallon (ft^2/gal) - assume 1 gallon of paint will cover 175 ft^2
        - Labour costs (assume labour cost is \$.18 / $ft^{2)}$
        - Additional labor costs include a taping charge of \$10.00 for each door or window in a room
        - Add a profit margin equal to 30% of the cost of paint and labour
        - Also assume that each of these constraints will change from time to time and you may eventually be asked to allow these amounts to be entered when running the program
        - Area/cost of paint will be dependent upon the number of coats of paint that need to be applied

        - In addition, when the final total is being calculated, you will need to round up the amount of paint to the nearest gallon as you cannot buy partial gallons of paint.
    - Area of a wall in a rectangular room = (length **or** width) * height
    - Area of a wall in a square room = length * height
    - Wall area to be painted = the area of the wall minus the sum of the area of all the windows and doors on that wall.
    - Total area for a room will have to calculate area for a room * number of coats of paint to be applied
    - You will need to calculate a total charge for taping based upon the number of windows/doors in a room

- You must use the following functions to do all the operations needed:

Function Name	Description
main	Controls flow of the program. Gets the initial inputs, iterates for the specified number of rooms, calls appropriate functions, calculates, and displays total paint required and cost.
getPaintPrice	Asks the user to enter the paint price and returns the value entered
getNumberOfCoats	Asks the user to enter the number of coats of paint to apply (1-4) and returns value entered
getNumberRooms	Asks the user to enter the number of rooms to paint and returns value entered
roomsMenu	Takes current room number as parameter, displays the rooms menu, asks user to enter menu option, returns menu option
computeRoomArea	Takes the menu option as a parameter and calls correct function for the menu option to determine the area and return the area
getNumberWindowsDoors	Asks the user to enter the number of windows and doors in a room and returns value
printRoomSummary	Takes current room number, area and paint price/gal as parameters and produces the summary report for a room
computeWindowsDoorsArea	Takes the number of windows/doors in a room as a parameter. and calculates the area for every door or window. Returns the total area of all windows/doors in a room
computeRectangleWallsArea	Asks the user to enter the length, width and height and calculates the surface area to be painted in the room and returns area
computeRectangleArea	Takes the length and width of a rectangle and returns the value of its area
computeSquareWallsArea	Asks the user to enter the side length of one wall side and calculates the surface area of the walls in the room.
computeCustomWallsArea	Asks the user to specify the number of walls in that room and calculates the room area

computeGallons	Takes the area as a parameter and returns the number of gallons of paint needed
computePaintPrice	Takes the area and paint price/gal as parameters, calculates and returns the cost of paint

Test Plan

Expected output – all inputs are highlighted with BOLD underline

Sample Run # 1

```
The Painter's Company Estimating Tool

Enter price of paint: 52.57
Enter number of coats of paint to apply (1-4): 2
How many rooms do you want to paint?: 3

Room: 1
Select the shape of the room:
1 - Rectangular
2 - Square
3 - Custom
Option: 2
Enter length of one wall in feet    : 15
Enter the height of the room in feet: 10

How many windows and doors are in the room? 3

Enter length for window/door 1 in feet: 4
Enter width  for window/door 1 in feet: 8
Enter length for window/door 2 in feet: 5
Enter width  for window/door 2 in feet: 7
Enter length for window/door 3 in feet: 6
Enter width  for window/door 3 in feet: 10

For Room: 1
      Area to be painted: 946.0 sq ft.
      Paint required    : 5.41 gallons
      Paint cost(approx): $284.18

Room: 2
Select the shape of the room:
1 - Rectangular
2 - Square
3 - Custom
Option: 1

Enter the length of the room in feet: 16
Enter the width  of the room in feet: 20
```

```
Enter the height of the room in feet: 15

How many windows and doors are in the room? 2

Enter length for window/door 1 in feet: 5
Enter width  for window/door 1 in feet: 12
Enter length for window/door 2 in feet: 5
Enter width  for window/door 2 in feet: 8

For Room: 2
        Area to be painted: 1960.0 sq ft.
        Paint required    : 11.20 gallons
        Paint cost(approx): $588.78

Room: 3
Select the shape of the room:
1 - Rectangular
2 - Square
3 - Custom
Option: 3

How many walls are there in the room? 3
Enter the length of wall 1 in feet: 8
Enter the height of wall 1 in feet: 10
Enter the length of wall 2 in feet: 6.5
Enter the height of wall 2 in feet: 10
Enter the length of wall 3 in feet: 5.5
Enter the height of wall 3 in feet: 10

How many windows and doors are in the room? 1

Enter length for window/door 1 in feet: 4
Enter width  for window/door 1 in feet: 8

For Room: 3
        Area to be painted: 336.0 sq ft.
        Paint required    : 1.92 gallons
        Paint cost(approx): $100.93

Customer Quote for All 3 rooms:
        Coats of paint to be applied: 2
        Total area to be painted    : 3242.0 sq ft.
        Paint required              : 19 gallons
        Total customer estimate     : $2,135.11
```

Sample Run # 2

```
The Painter's Company Estimating Tool

Enter price of paint: 47.19
Enter number of coats of paint to apply (1-4): 3
How many rooms do you want to paint?: 1

Room: 1
Select the shape of the room:
1 - Rectangular
2 - Square
3 - Custom
Option: 1

Enter the length of the room in feet: 9.5
Enter the width  of the room in feet: 12
Enter the height of the room in feet: 8

How many windows and doors are in the room? 3

Enter length for window/door 1 in feet: 3.5
Enter width  for window/door 1 in feet: 8
Enter length for window/door 2 in feet: 3.5
Enter width  for window/door 2 in feet: 8
Enter length for window/door 3 in feet: 6
Enter width  for window/door 3 in feet: 8

For Room: 1
        Area to be painted: 720.0 sq ft.
        Paint required    : 4.11 gallons
        Paint cost(approx): $194.15


Customer Quote for All 1 rooms:
        Coats of paint to be applied: 3
        Total area to be painted    : 720.0 sq ft.
        Paint required              : 5 gallons
        Total customer estimate     : $514.21
        (Includes paint, labor and overhead)
```

Marking Criteria

Group Submission

	Needs Improvement (0–50%)	Good (51–75%)	Excellent (76–100%)	Marks
Working code	• The project doesn't run in all scenarios • Input requests work but don't match the scenario • No conversion of data types • Syntax of if/else statements has mistakes • Loops do not follow best practices/not implemented correctly • No/little attempt to implement functions as specified • Output works but doesn't match the scenario	• The project runs in all scenarios • Input requests work but don't match the scenario • Some data types are not ideal • Correct use of if/else statements • Loops do not follow best practices/not implemented correctly • Some functions not designed/implemented as specified • Output works but doesn't match the scenario	• The project runs in all scenarios • Input requests match the scenario exactly • Correct data types used • Correct use of if/else statements • Most functions implemented as specified • Output matches the scenario • Loops follow best practices and implemented correctly	**/55**
Style	• Indentation – not consistent • Readability – poor variable names • Naming standards inconsistently followed	• Indentation – some parts are consistent and some are not • Readability – some variable names are not ideal	• Indentation – consistent • Readability – good variable names • Naming standards followed	**/10**

	• Lots of code duplication	• Naming standards inconsistently followed • Minimal code duplication	• Minimal code duplication	

Documentation	• Documentation
	  ○ No comments are included at the top.
	  ○ No docstring documentation for functions
	  ○ No comments indicating major code sections or what they do
		• Documentation
		  ○ Comments at the top are missing or incomplete.
		  ○ Functions docstring is missing or incomplete
		  ○ Comments indicating major code sections and what they do are incomplete
			• Documentation
			  ○ Comments at the top are complete and include name, date, program description including details on inputs, processing and outputs (4–5 sentences minimum).
			  ○ Function docstring complete for all/most functions
			  ○ Comments indicate major code sections and what they do
				/10

Testing	• Sample output doesn't match the provided test plan • Output is not formatted according to the specification (test plan)	• Parts of the sample output don't exactly match the provided test plan • Output formatted according to the specification (test plan)	• Sample output exactly matches the provided test plan • Output formatted according to the specification (test plan)	**/20**
Peer Assessment and Demonstration Video	• Not submitted		• Completed for all group members	**/5**
			Total	**/100**

