**1Student Name: Weight: 20%**

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

# Assignment: Functions, Scoping and Abstraction

## Scenario

Shiny Painting (SP) is an established small business that wants to become a national business by expanding across Canada. SP 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.

Shiny Painting executives have recognized that the company’s current quotation process is outdated and relies too heavily on manual calculations.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. Walls can be 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).

## Equipment and Materials

For this assignment, you will need:

* Python IDE

## Instructions

This assignment consists of three gradable components, all completed outside of class time. See the course schedule and Brightspace for exact dates.

**Individual Submission (20%)**

1. Working individually, 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.

**Note:** Check your program against the marking criteria for individual submissions. Keep in mind that you will be refining the program later as a group.

1. Submit the following to Brightspace:

* The code of the program that you implemented (.py file)
* A copy of the output (.txt file) from both test runs

**Group Submission (75%)**

1. After you’ve submitted your individual submission, join a group, as directed by your instructor.
2. Share your individual solutions with your group and work together to develop one common solution.
3. Check your solution against the detailed marking criteria at the end of this document.
4. Submit this final version of the code as a group. 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 (.txt file) from both test runs

**Peer Assessment (5%)**

Each student must also complete a peer assessment of their group members. Your instructor will provide further submission details.

## Program Requirements

* The application should use functions to ensure the usability of the code.
* When the user opens the application, the program should show a welcome message.
* 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 and 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 **total cost** of 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 the same color with the same paint
* Paint coverage in square feet per gallon (ft2/gal) - assume 1 gallon of paint will cover 350 ft2
* Cost of each gallon of paint ($CDN/gal) - assume 1 gallon of paint will cost $42.00/gallon
* Labour costs (assume labour cost is $.15 / ft2)
* 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
* 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.
* You must use the following functions to do all the operations needed:

|  |  |
| --- | --- |
| Function Name | Description |
| computeRoomArea | Takes the room number as a parameter, asks the user about the shape of the room and prints the room number, area to be painted and the cost |
| computeRectangleWallsArea | Asks the user to enter the length, width and height and calculates the surface area to be painted in the room |
| 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. |
| computeSquareArea | Takes the side length of a square and returns the value of its area |
| computeWindowsDoorsArea | Asks the user about the number of windows or doors in a room and calculates its area for every door or window |
| 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 as a parameter and returns the price of the gallons of paint needed |

## Test Plan

#### Expected output – all inputs are highlighted with BOLD underline

**Sample Run # 1**

Welcome to Shiny Paint Company for indoor painting!

How many Rooms do you want to paint?: **3**  
Thank you!

Room: 1  
Select the shape of the room:  
1 – Rectangular  
2 – Square  
3 - Custom (more or less than 4 walls, all square or rectangles)

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

For Room: 1, Area to be painted is 980.0 square ft and will require 2.80 gallons to paint. The paint will cost approximately $117.60

Room: 2  
Select the shape of the room:  
1 – Rectangular  
2 – Square  
3 - Custom (more or less than 4 walls, all square or rectangles)

Option: **2**  
Enter one side length of the room: **15**  
Enter the height of the room in feet: **10**

How many windows and doors are in the room? **3**

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

For Room: 2, Area to be painted is 473.0 square ft and will require 1.35 gallons to paint. The paint will cost approximately $56.76

Room: 3  
Select the shape of the room:  
1 – Rectangular  
2 – Square  
3 - Custom (more or less than 4 walls, all square or rectangles)

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**  
Enter the height of wall 2 in feet: **10**  
Enter the length of wall 3 in feet: **5**  
Enter the height of wall 3 in feet: **10**

How many windows and doors are in the room? **1**

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

For Room: 3, Area to be painted is 158.0 square ft and will require 0.45 gallons to paint. The paint will cost approximately $18.96

Total area to be painted is 1611.0 square ft and will require 5 gallons to paint.   
The total customer estimate including paint, labor, and overhead is $587.14.

**Sample Run # 2**

Welcome to Shiny Paint Company for indoor painting!  
  
How many Rooms do you want to paint?: **1**  
Thank you!

Room: 1  
Select the shape of the room:  
1 – Rectangular  
2 – Square  
3 - Custom (more or less than 4 walls, all square or rectangles)

Option: **1**  
Enter the length of the room in feet: **9**  
Enter the width of the room in feet: **12**  
Enter the height of the room in feet: **10**

How many windows and doors are in the room? **3**

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

For Room: 1, Area to be painted is 316.0 square ft and will require 0.90 gallons to paint. The paint will cost approximately $37.92

Total area to be painted is 316.0 square ft and will require 1 gallons to paint.  
The total customer estimate including paint, labor, and overhead is $116.22.

## Marking Criteria

### Individual Submission

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Needs Improvement (0–49%)** | **Good (51–75%)** | **Excellent (76–100%)** | **Marks** |
| **Individual work** | * Inputs are not entered as required and outputs are not generated as required | * Does not follow programming best practices * Some inputs are entered as required and some outputs are generated as required | * Program compiles, syntax, comments, readability, good programming best practices followed * Program is accurate * Inputs are entered as required and outputs are generated and formatted as required | **/20** |
| **Peer assessment** | * Not submitted | * Completed for some group members | * Completed for all group members | **/5** |

### 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 * Function use is poor * 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 * Correct use of functions * 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 * Correct use of functions * Output matches the scenario | **/55** |
| **Style** | * Indentation – not consistent * Readability – poor variable names * Documentation * No comments are included at the top. * No comments indicating major code sections or what they do | * Indentation – some parts are consistent and some are not * Readability – some variable names are not ideal * Documentation * Comments at the top are missing or incomplete. * Comments indicating major code sections and what they do are incomplete | * Indentation – consistent * Readability – good variable names * Documentation * Comments at the top are complete and include name, date, program description including details on inputs, processing and outputs  (4–5 sentences minimum). * 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) | **/10** |
| **Total** | | | | **/100** |