

CPE 150 Laboratory 3: Control Structures I

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1 Objectives

- To understand basic problem-solving techniques.
- To be able to develop algorithms through the process of top-down stepwise refinement.
- To be able to use the `if` and `if/else` structures to choose among alternative actions.
- To be able use the increment, decrement, assignment and logical operators.

2 Lab Exercise 1 - Body Mass Index

Write a program that calculates and displays a person's body mass index (BMI). The BMI is often used to determine whether a person with a sedentary lifestyle is overweight or underweight for his or her height. A person's BMI is calculated with the following formula:

$$\text{BMI} = \text{weight} \times 703 / \text{height}^2$$

where *weight* is measured in pounds and *height* is measured in inches. The program should display a message indicating whether the person has optimal weight, is underweight, or is overweight. A sedentary person's weight is considered to be optimal if his or her BMI is between 18.5 and 25. If the BMI is less than 18.5, the person is considered to be underweight. If the BMI value is greater than 25, the person is considered to be overweight.

3 Lab Exercise 2 - Geometry Calculator

Write a program that displays the following menu:

```
Geometry Calculator
1. Calculate the Area of a Circle
2. Calculate the Area of a Rectangle
3. Calculate the Area of a Triangle
4. Quit
Enter your choice (1-4):
```

If the user enters 1, the program should ask for the radius of the circle and then display its area. Use 3.14159 for π . If the user enters 2, the program should ask for the length and width of the rectangle and then display the rectangle's area. If the user enters 3, the program should ask for the length of the triangle's base and its height, and then display its area. If the user enters 4, the program should end.

[*Optional: Input Validation*] Display an error message if the user enters a number outside the range of 1 through 4 when selecting an item from the menu. Do not accept negative values for the circle's radius, the rectangle's length or width, or the triangle's base or height.

4 Lab Exercise 3 - Cellular Bill

Write a program that calculates and prints the bill for a cellular telephone company. The company offers two types of service: *regular* and *premium*. Its rates vary, depending on the type of service. The rates are computed as follows:

- Regular service: \$10.00 plus first 50 minutes are free. Charges for over 50 minutes are \$0.20 per minute.
- Premium service: \$25.00 plus:
 1. For calls made from 6 : 00 a.m. to 6 : 00 p.m., the first 75 minutes are free; charges for more than 75 minutes are \$0.10 per minute.
 2. For calls made from 6 : 00 p.m. to 6 : 00 a.m., the first 100 minutes are free; charges for more than 100 minutes are \$0.05 per minute.

The program must prompt the user to enter the total number of call minutes made between 6 : 00 a.m. to 6 : 00 p.m and the total number of call minutes made between 6 : 00 p.m. to 6 : 00 a.m. Finally, the program calculates and prints the due amount.

5 Postlab Exercise

Write a program that plots a regression line: that is, the line with the best fit through a collection of points. First the program asks the user to specify 5 data points (x, y) . The regression line is the line with equation:

$$y = \bar{y} + m(x - \bar{x}), \text{ where } m = \frac{\sum x_i y_i - n \bar{x} \bar{y}}{\sum x_i^2 - n \bar{x}^2}$$

\bar{x} is the mean of the x -values and \bar{y} is the mean of y -values and n is the number of data points which is set to 5 in this exercise.