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**CPT 111 – PRINCIPLES OF PROGRAMMING**  
**WEEK 4: PROGRAMMING LAB**  
**Selection Control Structure**

**1. Absolute of a Number**

The absolute of a number is its value without the sign. Write a program that asks the user to enter a number and finds the absolute of the number using the conditional operator.

**2. Minimum/Maximum**

Write a program that asks the user to enter two numbers. The program should use the conditional operator to determine which number is the smaller and which is the larger.

**3. Age Check**

A company is hiring new recruits who should be within 18 to 28 years of age. Write a program that asks the user to input the current year and an applicant's year of birth. It then display the age and a message indicating whether the applicant is eligible.

**4. Areas of Rectangles**

The area of a rectangle is the rectangle's length times its width. Write a program that asks for the length and width of two rectangles. The program should tell the user which rectangle has the greater area, or if the areas are the same.

**5. 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.

## 6. Color Mixer

The colors red, blue, and yellow are known as the primary colors because they cannot be made by mixing other colors. When you mix two primary colors, you get a secondary color, as shown here:

When you mix red and blue, you get purple.

When you mix red and yellow, you get orange.

When you mix blue and yellow, you get green.

Write a program that prompts the user to enter the names of two primary colors to mix. If the user enters anything other than “red,” “blue,” or “yellow,” the program should display an error message. Otherwise, the program should display the name of the secondary color that results by mixing two primary colors.

## 7. Math Tutor

Write a program that can be used as a math tutor for a young student. The program should display two random numbers that are to be added, such as:

247  
+ 129

The program should wait for the student to enter the answer. If the answer is correct, a message of congratulations should be printed. If the answer is incorrect, a message should be printed showing the correct answer.

## 8. Shipping Charges

The Fast Freight Shipping Company charges the following rates:

Weight of Package (in Kilograms)	Rate per 500 Miles Shipped
2 kg or less	\$1.10
Over 2 kg but not more than 6 kg	\$2.20
Over 6 kg but not more than 10 kg	\$3.70
Over 10 kg but not more than 20 kg	\$4.80

Write a program that asks for the weight of the package and the distance it is to be shipped, and then displays the charges.

*Input Validation: Do not accept values of 0 or less for the weight of the package. Do not accept weights of more than 20 kg (this is the maximum weight the company will ship). Do not accept distances of less than 10 miles or more than 3,000 miles. These are the company's minimum and maximum shipping distances.*

## 9. Negative Split

Running the second half of a race faster than the first half is called a negative split.

Write a program that asks for the time (in seconds) for the first half of a race and for

the total of the race, and outputs a congratulatory messages in case of a negative split.

*Input validation: Do not accept negative values for either time. Also check that the second time is greater than the first time.*

## 10. The Speed of Sound in Gases

When sound travels through a gas, its speed depends primarily on the density of the medium. The less dense the medium, the faster the speed will be. The following table shows the approximate speed of sound at 0 degrees centigrade, measured in meters per second, when traveling through carbon dioxide, air, helium, and hydrogen.

Medium	Speed (Meters per Second)
Carbon Dioxide	258.0
Air	331.5
Helium	972.0
Hydrogen	1,270.0

Write a program that displays a menu allowing the user to select one of these four gases. After a selection has been made, the user should enter the number of seconds it took for the sound to travel in this medium from its source to the location at which it was detected. The program should then report how far away (in meters) the source of the sound was from the detection location.

*Input Validation: Check that the user has selected one of the available menu choices. Do not accept times less than 0 seconds or more than 30 seconds.*