

Soft Skills

Programmers need to be able to look at alternative approaches to solving a problem and at different ways of implementing a solution, weighing the pros and cons of each. Further, they need to be able to clearly articulate to others why they recommend, or have chosen, a particular solution. Come to class prepared to discuss the following:

36. Sometimes either a `switch` statement or an `if/else if` statement can be used to implement logic that requires branching to different blocks of program code. But the two are not interchangeable.
- A) Under what circumstances would an `if/else if` statement be a more appropriate choice than a `switch` statement?
 - B) Under what circumstances would a `switch` statement be a more appropriate choice than an `if/else if` statement?
 - C) Under what circumstances would a set of nested `if/else` statements be more appropriate than either of the other two structures?

Try to come up with at least one example case for each of the three, where it is the best way to implement the desired branching logic.

Programming Challenges

1. 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.

2. Roman Numeral Converter

Write a program that asks the user to enter a number within the range of 1 through 10. Use a `switch` statement to display the Roman numeral version of that number.

Input Validation: Do not accept a number less than 1 or greater than 10.

3. Magic Dates

The date June 10, 1960, is special because when we write it in the following format, the month times the day equals the year.

6/10/60

Write a program that asks the user to enter a month (in numeric form), a day, and a two-digit year. The program should then determine whether the month times the day is equal to the year. If so, it should display a message saying the date is magic. Otherwise, it should display a message saying the date is not magic.

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. Book Club Points

An online book club awards points to its customers based on the number of books purchased each month. Points are awarded as follows:

Books Purchased	Points Earned
0	0
1	5
2	15
3	30
4 or more	60

Write a program that asks the user to enter the number of books purchased this month and then displays the number of points awarded.

6. Mass and Weight

Scientists measure an object's mass in kilograms and its weight in newtons. If you know an object's mass, you can calculate its weight in newtons with the following formula:

$$\text{weight} = \text{mass} \times 9.8$$

Write a program that asks the user to enter an object's mass, and then calculates and displays its weight. If the object weighs more than 1000 newtons, display a message indicating that it is too heavy. If the object weighs less than 10 newtons, display a message indicating that the object is too light.

7. Time Calculator

Write a program that asks the user to enter a number of seconds.

- There are 86400 seconds in a day. If the number of seconds entered by the user is greater than or equal to 86400, the program should display the number of days in that many seconds.
- There are 3600 seconds in an hour. If the number of seconds entered by the user is less than 86400, but is greater than or equal to 3600, the program should display the number of hours in that many seconds.
- There are 60 seconds in a minute. If the number of seconds entered by the user is less than 3600, but is greater than or equal to 60, the program should display the number of minutes in that many seconds.

8. Math Tutor

This is a modification of the math tutor problem in Chapter 3. Write a program that can be used as a math tutor for a young student. The program should display two random numbers between 10 and 50 that are to be added, such as:

$$\begin{array}{r} 24 \\ + 12 \\ \hline \end{array}$$

The program should then 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.



VideoNote
Solving
the Time
Calculator
Problem



9. Software Sales

A software company sells a package that retails for \$99. Quantity discounts are given according to the following table.

Quantity	Discount
10–19	20%
20–49	30%
50–99	40%
100 or more	50%

Write a program that asks for the number of units purchased and computes the total cost of the purchase.

Input Validation: Make sure the number of units is greater than 0.

10. Bank Charges

A bank charges \$10 per month plus the following check fees for a commercial checking account:

- \$.10 each for fewer than 20 checks
- \$.08 each for 20–39 checks
- \$.06 each for 40–59 checks
- \$.04 each for 60 or more checks

Write a program that asks for the number of checks written during the past month, then computes and displays the bank's fees for the month.

Input Validation: Do not accept a negative value for the number of checks written.

11. Geometry Calculator

Write a program that displays the following menu:

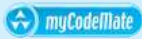
Geometry Calculator

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.

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.



12. Running the Race

Write a program that asks for the names of three runners and the time it took each of them to finish a race. The program should display who came in first, second, and third place. Think about how many test cases are needed to verify that your problem works correctly. (That is, how many different finish orders are possible?)

Input Validation: Only accept positive numbers for the times.

13. Personal Best

Write a program that asks for the name of a pole vaulter and the dates and vault heights (in meters) of the athlete's three best vaults. It should then report in height order (best first), the date on which each vault was made, and its height.

Input Validation: Only accept values between 2.0 and 5.0 for the heights.

14. 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.

15. Fat Gram Calculator

Write a program that asks for the number of calories and fat grams in a food. The program should display the percentage of calories that come from fat. If the calories from fat are less than 30 percent of the total calories of the food, it should also display a message indicating the food is low in fat.

One gram of fat has 9 calories, so

$$\text{Calories from fat} = \text{fat grams} * 9$$

The percentage of calories from fat can be calculated as

$$\text{Calories from fat} \div \text{total calories}$$

Input Validation: Make sure the number of calories is greater than 0 and the number of fat grams is 0 or more. Also, the number of calories from fat cannot be greater than the total number of calories. If that happens, display an error message indicating that either the calories or fat grams were incorrectly entered.