

# Programming for Big Data

## Question 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.

## Question 2 – Roman Numeral Converter

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

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

## Question 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.

## Question 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.

## Question 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.

## Question 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:

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

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.

## Question 7 – Time Calculator

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

1. 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.
2. 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.
3. 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.

## Question 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.

## Question 9 – Software Sales

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

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

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.*

## Question 10 – Bank Charges

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

1. \$.10 each for fewer than 20 checks

2. \$.08 each for 20 – 39 checks
3. \$.06 each for 40 – 59 checks
4. \$.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.*

## Question 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  $\pi$ . 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.*

## Question 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.*

## Question 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.*

## Question 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:

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

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.

## Question 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  
 $\text{Calories from fat} / \text{total calories}$

**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.

## Question 16 – The Speed of Sound

The speed of sound varies depending on the medium through which it travels. In general, sound travels fastest in rigid media, such as steel, slower in liquid media, such as water, and slowest of all in gases, such as air. The following table shows the approximate speed of sound, measured in feet per second, in air, water, and steel. Write a program that displays a menu allowing

Medium	Speed (feet per sec.)
Air	1,100
Water	4,900
Steel	16,400

the user to select air water, or steel. After the user has made a selection, the number of feet a sound wave will travel in the selected medium should be entered. The program will then display the amount of time it will take. (Round the answer to four decimal places.)

**Input Validation:** Check that the user has selected one of the available menu choices. Do not accept distances less than 0.

## Question 17 – The Speed of Sound in Gases

When traveling through a gas, the speed of sound 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 degree celsius, measured in meters per second, when traveling through carbon dioxide, air, helium, and hydrogen. Write a program that displays a menu allowing

Medium	Speed (meters per sec.)
Carbon dioxide	258.0
Air	331.5
Helium	972.0
Hydrogen	1270.0

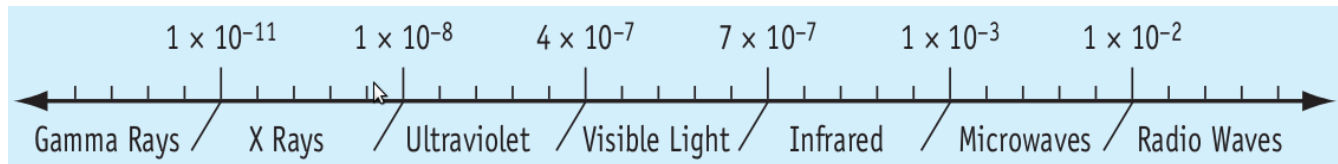
the user to select one of these 4 gases. After a selection has been made, the user should enter the number of seconds it took for the sound to travel in this medium from its source to the location at which it was detected. The program should then report how far away (in meters) the source of the sound 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.

## Question 18 – Spectral Analysis

If a scientist knows the wavelength of an electromagnetic wave she can determine what type of radiation it is. Write a program that asks for the wavelength in meters of an electro-magnetic wave and then displays what that wave is according to the following

chart. (For example, a wave with a wavelength of  $1\text{E}-10$  meters would be an X-ray.)



## Question 19 – Long-Distance Calls

A long-distance carrier charges the following rates for telephone calls between the United States and Mexico: Write a program

Starting Time of Call	Rate per Minute
00:00 – 06:59	\$0.12
07:00 – 19:00	0.55
19:01 – 23:59	0.35

that asks for the starting time and the number of minutes of the call, and displays the charges. The program should ask for the time to be entered as a floating-point number in the form HH.MM. For example, 07:00 hours will be entered as 07.00, and 16:28 hours will be entered as 16.28.

*Input Validation:* The program should not accept times that are greater than 23:59. Also, no number whose last two digits are greater than 59 should be accepted.

**Hint:** Assuming `num` is a floating-point variable, the following expression will give you its fractional part:  
`num - static_cast<int>(num)`

## Question 20 – Freezing and Boiling Points

The following table lists the freezing and boiling points of several substances. Write a program that asks the user to enter a temperature, and then shows all the substances that will freeze at that temperature and all that will boil at that temperature. For example, if the user enters -20 the program should report that water will freeze and oxygen will boil at that temperature.

Substance	Freezing Point (°F)	Boiling Point (°F)
Ethyl alcohol	-173	172
Mercury	-38	676
Oxygen	-362	-306
Water	32	212

## Question 21 – Internet Service Provider

An Internet service provider has three different subscription packages for its customers: Write a program that calculates a

- Package A: For \$9.95 per month 10 hours of access are provided. Additional hours are \$2.00 per hour.
- Package B: For \$14.95 per month 20 hours of access are provided. Additional hours are \$1.00 per hour.
- Package C: For \$19.95 per month unlimited access is provided.

customer's monthly bill. It should input customer name, which package the customer has purchased, and how many hours were used. It should then create a bill that includes the input information and the total amount due.

*Input Validation:* Be sure the user only selects package A, B, or C. Also, the number of hours used in a month cannot exceed 744.