NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES ISLAMABAD CAMPUS
Programming Fundamentals (CS118)
FALL 2019 ASSIGNMENT # 1

Due Date: September 16, 2019 (12:00 pm)

Instructions:

1. Design the solutions to the following problems.

2. Write the pseudo-code along with three dry-runs (hand-traces on different user inputs) corresponding to every problem validating your solution.

3. Use Microsoft Word ".docx" (or LibreOffice Writer ".odt" file on Ubuntu) file to write your solutions. Please discuss (send an email) with your instructor if you want to use some other software.

4. Start writing your solution to each problem on a new page.

5. Write your name and roll number (as a block comment) at the beginning of the solution of each problem.

6. Use the proper naming convention for your submission file. For example, the file containing the pseudo-codes and dry-runs for this (first) assignment should be named as i19xxxx_assignment_1.docx (or i19xxxx_assignment_1.odt), replace i19xxxx with your registration (roll) number.

7. Submit the .docx / .odt file on slate. Submissions on email will not be accepted.

Plagiarism: Plagiarism is not allowed. If found plagiarized, you will be awarded zero marks in the assignment.

Note:
- **Don't upload compressed/zip file**
- **Follow the given instruction to the letter, failing to do to so will result in a zero.**

Problem 1: Write the algorithm of a program that reads two numbers and outputs the largest.

Problem 2: Write the algorithm of a program that reads three numbers and outputs the largest.

Problem 3: Write the algorithm of a program that reads two numbers and outputs them in increasing order.

Problem 4: Write the algorithm of a program that reads three numbers and outputs them in increasing order.

Problem 5: Write the algorithm of a program that reads two numbers and outputs the smallest.

Problem 6: Write the algorithm of a program that reads three numbers and outputs the smallest.

Problem 7: Write the algorithm of a program that reads two numbers and outputs them in decreasing order.

Problem 8: Write the algorithm of a program that reads three numbers and outputs them in decreasing order.

Problem 9: Write the algorithm of a program that reads three numbers and prints the average of these.

Problem 10: Write the algorithm of a program that reads the score of a student in a subject and displays his grade according to the following criteria:

Score	Grade
>= 90	A+
80 – 89	A
70 – 79	B
60 – 69	C
50 – 59	D
< 50	F

Problem 11: Write the algorithm of a program that reads the user's age and then outputs "You are a child." if the age < 18, "You are an adult." if age < 65, and "You are a senior citizen." if age >= 65.

Problem 12: Write the algorithm of a program that simulates a simple calculator. It reads two numbers and a character. If the character is a +, the sum is printed; if it is a - the difference is printed; if it is a *, the product is printed; and if it is a /, the quotient is printed.

Problem 13: Write the algorithm of a program that prompts the user for entering a number, say x, and prints 1, 2, 3, …, x-1, x, x-1, …, 3, 2, 1. Assume that x > 1. For example, if the input is 5, the output should be 1 2 3 4 5 4 3 2 1, similarly if the input is 2, the output should be 1 2 1.

Problem 14: Write the algorithm of a program that prompts the user for entering a number and outputs the factorial of that number.

Problem 15: Write the algorithm of program that evaluates the series 5-10+7+15+9-20+11+25+… up to x terms, where the value of x is taken as input from the user. For example, the sum of the given series up to 3 terms should give 2 as output
(5-10+7=2), similarly, the sum of this series up to 4 terms should give 17 as output
 (5-10+7+15=17), etc.

Problem 16: A large company pays its salespeople on a commission basis. The sales people each receive Rs. 2,000 per week plus 9% of their gross sales for that week. For example, a sales person who sells Rs. 50,000 worth of chemicals in a week receives Rs. 2,000 plus 9% of Rs. 50,000, or a total of Rs. 6500. Develop the algorithm of the program that uses a while statement to input each salesperson's gross sales for last week and calculates and displays that salesperson's earnings. Process one salesperson's figures at a time. The program should terminate if the users enters a negative value as his gross sales for last week.

```
Enter sales in rupees (negative value to exit):
50000 Salary is: Rs. 6500

Enter sales in rupees (negative value to exit):
60000 Salary is: Rs. 7400

Enter sales in rupees (negative value to exit):
70000 Salary is: Rs. 8300

Enter sales in rupees (negative value to exit): -1
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Problem 17: Develop the algorithm of a program that uses a while statement to determine the gross pay for each of several employees. The company pays "straight time" for the first 40 hours worked by each employee and pays "time-and-a-half" for all hours worked in excess of 40 hours. You are given a list of the employees of the company, the number

of hours each employee worked last week and the hourly rate of each employee. Your program should input this information for each employee and should determine and display the employee's gross pay. Enter -1 hours to exit.

Problem 18: The process of finding the largest number (i.e., the maximum of a group of numbers) is used frequently in computer applications. For example, a program that determines the winner of a sales contest inputs the number of units sold by each sales person. The sales person who sells the most units wins the contest. Write the algorithm of a program that uses a while statement to determine and print the largest number of all the non-negative numbers input by the user. A negative number entered by the user serves as the sentinel value. Your program should use two variables, as follows:

number: The current number input to the program.
largest: The largest number found so far.

Problem 19: Using an approach similar to that in Problem 18, write algorithm to find the two largest values among all the numbers. [Note: You must input each number only once.]

Problem 20: Write the algorithm of a program that calculates a car's gas mileage. The program should ask the user to enter the number of gallons of gas the car can hold, and the number of miles it can be driven on a full tank. It should then display the number of miles that may be driven per gallon of gas.

Problem 21: Write the algorithm of a program that asks for five test scores. The program should calculate the average test score and display it.

Problem 22: Write the algorithm of a program that asks for a set of test scores. The program keeps taking the input from the user as long as the score is non--negative. As soon as the user enters a negative value, the program should calculate the average test score and display it. You cannot make any assumption about the total number of scores, therefore, an array or a list is not suitable for this program. You should implement the solution using at most four variables.

```
Enter the score: 79
Enter the score: 85
Enter the score: 67
Enter the score: 56
Enter the score: -5

Average = 71.75
```

Problem 23: A bag of cookies holds 40 cookies. The calorie information on the bag claims that there are 10 servings in the bag and that a serving equals 300 calories. Write the algorithm of a program that asks the user to input how many cookies he or she actually ate and then reports how many total calories were consumed.

Problem 24: Write the algorithm of a program that reads Celsius temperature and convert it to Fahrenheit temperature. The formula is

$$F = \frac{9}{5}C + 32$$

where F is the Fahrenheit temperature and C is the Celsius temperature.

Problem 25: Write the algorithm of 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 persons BMI is calculated with the following formula:

$$BMI = weight \times 703 / height^2$$

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.

Problem 26: 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 the algorithm of a program that asks for the number of units sold and computes the total cost of the purchase. Input Validation: Make sure the number of units is greater than 0.

Problem 27: The area of a rectangle is the rectangle's length times its width. Write the algorithm of 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.

Problem 28: Scientists measure an object s mass in kilograms and its weight in newtons. If you know the amount of mass that an object has, you can calculate its weight, in newtons, with the following formula:

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

Write the algorithm of 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 1,000 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.

Problem 29: Write the algorithm of a program that uses a loop to display a table of the Celsius temperatures 0-20, and their Fahrenheit equivalents. [Refer to Problem 24]

Problem 30: Write the algorithm of a program that asks the user to enter today's sales for five stores (rounded to nearest $100). The program should then display a bar graph comparing each store's sales. Create each bar in the bar graph by displaying a row of asterisks. Each asterisk should represent $100 of sales.

Here is an example of the program's output.

Enter today's sales for store 1:
1000 [Enter]
Enter today's sales for store 2:
1200 [Enter]
Enter today's sales for store 3:
1800 [Enter]
Enter today's sales for store 4:
800 [Enter]
Enter today's sales for store 5:
1900 [Enter]

SALES BAR CHART (Each * = $100)
Store 1: **********
Store 2: ************
Store 3: ******************

Store 4: ********
Store 5: *****************

Problem 31: Write the algorithm of a program that produces a bar chart showing the population growth of Prairieville, a small town in the Midwest, at 20-year intervals during the past 100 years. The program should read in the population figures (rounded to the nearest 1,000 people) for 1900, 1920, 1940, 1960, 1980, and 2000. For each year it should display the date and a bar consisting of one asterisk for each 1,000 people.

Here is an example of how the chart might begin:
PRAIRIEVILLE POPULATION GROWTH (each * represents 1,000 people)
1900 **
1920 ****
1940 *****