National University of Computer & Emerging Sciences, Karachi
School of Computing
Fall-2021

CS1002 – Programming Fundamentals

Assignment # 2

Max Points: 100 **Due Date:** Sunday, Oct xx, 2021, 11:59 p.m.

Carefully read the following instructions!

- It should be clear that your assignment would not get any credit if the assignment is submitted after the due date.
- Strict actions will be taken if the submitted solution is copied from any other student.
- For any query, feel free to email at: **sumaiyah@nu.edu.pk**
- If you find any confusion in the assignment (Question statement), please consult at least two days before the deadline. After that no queries will be entertained in this regard.
- **Submission:** Submission will only be accepted through GOOGLE CLASSROOM. Upload a .zip or .rar file containing all your paperwork (for P1, P2, and P5) and C source files. Before submission, rename your .zip or .rar file as your ID **"KXX-XXXX".**

Problem: 1

Write appropriate data types for each of the following items. Provide one line justification for your choice. Solve this problem on a paper sheet.

a) Age of a person (in years)
b) Speed of light
c) Gender
d) Coordinates of a point
e) Factorial of a number
f) The number of plants in a region
g) Mass of an electron

Problem: 2

Predict the output of the following expressions. Also, justify your answer by solving the expressions manually. Solve this problem on a paper sheet.

a) If **d** is a float, then the operation **d=2/7** would store _____in **d**.
b) If **x** is an integer, then the expression **x=-7%2-8** would evaluate to _____.
c) If **c=0**, then the expression **5&&c!=8||!c** would evaluate to _____.
d) The expression **a=b=c=3+4** would evaluate to: a=___, b=___, c=___.
e) The expression **y=z=-3%-8/2+7** would evaluate to: y=_____, z=_____.

Problem: 3

Write a program that asks a user to enter the length and angles for all four sides of a quadrilateral, then determines if it is a square, rectangle, rhombus, kite, parallelogram, or trapezoid. Also, draw the flow chart for this program.

Problem: 4

Write a program that reads a 4 digit (or fewer) positive integer and determines how many digits in the integer are equal to the last character of your Roll number, and prints the result on the screen. If a user enters a negative integer or an integer greater than 4 digits, print a message on the screen: "Invalid integer! Execute program again and enter a valid integer." Also, write the algorithm/pseudocode for this program.

Output samples:

```
Enter a four digit positive integer: 8956
Enter the last character of your roll number: 6
6 occured 1 times

--------------------------------
Process exited after 15.71 seconds with return value 18
Press any key to continue . . .
```

```
Enter a four digit positive integer: 56897
Invalid input! Execute program again and then enter a valid integer.
--------------------------------
Process exited after 3.511 seconds with return value 68
Press any key to continue . . .
```

```
Enter a four digit positive integer: -56
Invalid input! Execute program again and then enter a valid integer.
--------------------------------
Process exited after 4.714 seconds with return value 68
Press any key to continue . . .
```

Problem: 5

Point out errors, if any, in the following programs. Otherwise, write down and explain the output of the programs. Solve this problem on a paper sheet.

No.	Program	Output

a.	main( ){
	int i = 4, j = -1, k = 0, w, x, y, z ;
	w = i || j || k ;
	x = i && j && k ;
	y = i || j && k ;
	z = i && j || k ;
	printf ("\nw = %d x = %d y = %d z = %d", w, x, y, z) ;
	}	

b.	main(){
	int i = 2, j = 3, k, l ;
	float a, b ;
	k = i / j * j ;
	l = j / i * i ;
	a = i / j * j ;
	b = j / i * i ;
	printf("%d %d %f %f", k, l, a, b) ;
	}	

c.	main( )
	{
	int m,n;
	m = -3%2!=!3 ;
	n = -3*10.5/2 - 3 ;
	printf ("a = %d\nb = %f", m, n) ;
	}	

Problem: 6

A palindrome is a number or a text phrase that reads the same backward as forward. For example, each of the following five-digit integers is a palindrome: 12321, 55555, 45554 and 11611. Write a program that reads a five-digit integer and determines whether or not it is a palindrome. Also, the program prints error if the number of digits is greater than 5.

Output Samples:

```
Enter a five digit positive integer: 56898
It is not a palindrome.
--------------------------------
Process exited after 5.853 seconds with return value 23
Press any key to continue . . .
```

```
Enter a five digit positive integer: 56865
It is a palindrome!
--------------------------------
Process exited after 8.393 seconds with return value 19
Press any key to continue . . .
```

```
Enter a five digit positive integer: 5665
Error! Invalid input. Please try again.
--------------------------------
Process exited after 8.87 seconds with return value 39
Press any key to continue . . .
```

```
Enter a five digit positive integer: -5665
Error! Invalid input. Please try again.
--------------------------------
Process exited after 4.798 seconds with return value 39
Press any key to continue . . .
```

Problem: 7

Given three points (x1,y1), (x2,y2), (x3,y3), and (x4,y4) write a program to check if all the three points fall on one straight line. Hint: If the slopes of any three pair of points out of four are the same, then the points are said to be colinear, that is, they fall on one straight line. Also, write the algorithm/pseudocode for this program.

Output Samples:

```
Enter the coordinates of the first point (x1,y1): 1 2
Enter the coordinates of the second point (x2,y2): 2 4
Enter the coordinates of the third point (x3,y3): 3 6
Enter the coordinates of the third point (x4,y4): 4 8
The given points fall on a straight line!
--------------------------------
Process exited after 23.06 seconds with return value 41
Press any key to continue . . .
```

```
Enter the coordinates of the first point (x1,y1): 1.1 2.3
Enter the coordinates of the second point (x2,y2): 1 6
Enter the coordinates of the third point (x3,y3): 2.2 3
Enter the coordinates of the third point (x4,y4): 3.3 4
The given points do not fall on a straight line!
--------------------------------
Process exited after 16.45 seconds with return value 48
Press any key to continue . . .
```

Problem: 8

Develop a solution to change Roman numerals into their decimal equivalents using switch case. Consider only two possibilities of Roman numerals—only one letter, and two letters. One Roman numeral character is entered at a time. The Roman numeral is entered from left to right. Roman numeral equivalents are as follows:

I = 1
V = 5
X = 10
L = 50
C = 100
D = 500
M = 1000

```
How many characters are there in your Roman Number?2
Enter the first character V
Enter the second character M
Decimal equivalent is 995 .
--------------------------------
Process exited after 5.145 seconds with return value 27
Press any key to continue . . .
```

Problem: 9

Assume that the last two digits of your Roll number form an integer. Write a program that converts this integer into its binary equivalent. The program also converts the resultant binary number back to its decimal equivalent. Also, the program should print an error message if more than two digits are entered by the user. **Hint:** if your roll no is 21k-1964, then the input to the program becomes 64. The program should print the binary equivalent of 56 as 111000 and the decimal equivalent of 111000 as 56. Also, write the algorithm/pseudocode for this program.

Output Samples:

```
Enter the last 2 digits of your roll number: 56
The binary equivalent of 56 is 111000
The decimal equivalent of 111000 is 56
Hurrah!! your program is correct.
--------------------------------
Process exited after 1.052 seconds with return value 33
Press any key to continue . . .
```

```
Enter the last 2 digits of your roll number: 897
Invalid input. Please try again!
--------------------------------
Process exited after 3.264 seconds with return value 32
Press any key to continue . . .
```

```
Enter the last 2 digits of your roll number: -56
Invalid input. Please try again!
--------------------------------
Process exited after 2.394 seconds with return value 32
Press any key to continue . . .
```

Problem: 10

A company that wants to send data over the Internet has asked you to write a program that will encrypt it so that it may be transmitted more securely. All the data is transmitted as four-digit integers. Your application/program should read a four-digit integer entered by the user and *encrypt* it as follows: Replace each digit with the result of adding 5 to the digit and getting the remainder after dividing the new value by 8. Then swap the first digit with the second, and swap the third digit with the fourth. Then print the encrypted integer. Write a separate application/program that inputs an encrypted four-digit integer and *decrypts* it (by reversing the encryption scheme) to form the original number. In the end, compare the original input and decrypted integer. If the two numbers are the same, then the encryption and decryption has been performed successfully. Also, draw the flow chart for this program.

Output Samples:

```
Enter any four digit integer: 5689
The encrypted integer is 3265
The decrypted integer is 5689
The data before encryption and after decryption is the same. Congrats!
--------------------------------
Process exited after 4.297 seconds with return value 70
Press any key to continue . . .
```

```
Enter any four digit integer: 2389
The encrypted integer is 765
The decrypted integer is 2339
The data before encryption and after decryption is not the same. Troubleshoot your code.!
--------------------------------
Process exited after 1.61 seconds with return value 89
Press any key to continue . . .
```

```
Enter any four digit integer: -5689
Invalid input. Try again.
--------------------------------
Process exited after 2.803 seconds with return value 25
Press any key to continue . . .
```

```
Enter any four digit integer: 56
Invalid input. Try again.
--------------------------------
Process exited after 2.398 seconds with return value 25
Press any key to continue . . .
```

```
Enter any four digit integer: 56899
Invalid input. Try again.
--------------------------------
Process exited after 2.456 seconds with return value 25
Press any key to continue . . .
```

XXXXX Good Luck XXXXX