


National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Introduction to Computing	Course Code:	CS101
	Program:	BS(CS)	Semester:	Spring 2018
	Duration:	3 hr	Total Marks:	80
	Paper Date:	Monday, 21 May 2018	Weight	40
	Section:	ALL	Page(s):	8
	Exam Type:	Final	Roll No - Sec	-

Instruction/Notes:

1. Solve the exam on this question paper.
2. You can use sheets for rough work but **do not attach or submit**, with paper.

Marks Obtained	Q1	Q2	Q3	Q4	Q5	Total

Question # 1: Write the output of following code.

[10 Marks]

```
void doSomeMoreWork(int & m, int & n, char ch){
    for (int i = 0; i < n; i++){
        for (int j = 0; j < n - i - 1; j++)
            cout << ch;
        for (int j = 0; j < m; j++)
            cout << " ";
        for (int j = 0; j < n - i - 1; j++)
            cout << ch;
        m = m + 2;
        cout << endl;
    }
    n = m + n;
}
```

```
void doSomework(int & n, char ch){
    n = n / 2 + 1;
    int m = (n * 2) - 1;
    for (int i = 0; i < n - 1; i++){
        for (int j = 0; j < i; j++)
            cout << ch;
        for (int j = 0; j < m; j++)
            cout << " ";
        for (int j = 0; j < i; j++)
            cout << ch;
        m = m - 2;
        cout << endl;
    }
    m = 1;
    doSomeMoreWork(m, n, ch);
}
```

```
int main()
{
    int n = 6;
    char ch = '@';
    doSomework(n, ch);
    cout << "n: " << n << endl;
    cout << "ch: " << ch << endl;
    return 0;
}
```

Output:

Question # 2:

[15 Marks]

Write a C++ function "**ScrambleWord**" that changes the order of characters in a word in a given string. For changing the order of letters, the simplest thing you could do is either sort the word in ascending or descending order. For example, if the string given to the function is, "**National University of Computer and Emerging Sciences**", and the word to scramble is "**Computer**", then the original string should change to, "**National University of Cemoprtu and Emerging Sciences**", if the word is sorted in ascending order.

Question # 3:

[2+3+10= 15 Marks]

Robotics International is starting its new project “**RoboCleaner**”. RoboCleaner is a robot which will clean the carpets. For cleaning, it divides a carpet into 8×8 blocks. If there is any garbage in a cell then those cells in block are marked **dirty** (by character ‘d’), otherwise it is marked **clean** (by character ‘c’). The block having RoboCleaner in it, is marked with character ‘*’ (star). RoboCleaner always keeps its face towards the first row. It has four eyes so it can see in four directions i.e. front, back, left and right (from the cell in which it is standing).

	F								
	d	d	d	d	d	d	d	d	
	d	d	d	c	c	c	c	d	
	d	d	d	c	c	c	c	d	
L	d	d	d	d	*	d	c	d	R
	d	d	c	c	c	c	c	d	
	d	d	d	c	c	c	c	d	
	d	d	c	c	c	c	d	d	
	d	d	d	d	c	c	d	d	
	B								

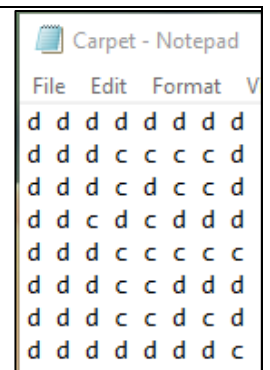
Figure 1 – 8x8 carpet's sample configuratio

For example, according to the carpet configuration shown in Figure 1, **RoboCleaner's eyes give following readings:**

Front Eye – 1 dirty block(s) in the front	Back Eye – 0 dirty block(s) at the back
Right Eye – 2 dirty block(s) on right	Left Eye – 3 dirty block(s) on left

Your task is to write a program which performs following tasks:

1. Declare a carpet of 8x8 blocks and initialize blocks' state as given in file carpet.txt and
2. Ask user to enter current position of robot (current row and current column. you can assume that user will never enter out of bound indices). Mark the cell having robot in it (robot can overwrite a dirty or clean block)



3. Print the carpet.

4. Write a function **SeeCarpet** which will print the information seen by all four eyes of the robot from its current position as given in example.

Question # 4:

[7+ 3= 10 Marks]

A positive integer is called an Armstrong number, if the sum of cubes of individual digits of number is equal to that number itself. For example

Number **153** is Armstrong because sum of cubes of individual digits $(1 * 1 * 1 + 5 * 5 * 5 + 3 * 3 * 3) = 153$

Number **12** is not Armstrong because sum of cubes of individual digits $(1 * 1 * 1 + 2 * 2 * 2) = 9$

- a. Write a C++ function that takes an integer as parameter and finds whether the number is Armstrong or not and return true or false accordingly.

- b. Write a C++ function which takes 1-D array of integers and its size as input and it removes all of the Armstrong numbers from this array. (May require shifting)

Question # 5:

[10+5+15= 30 Marks]

A diagonal-constant matrix, is a square matrix in which each descending diagonal from left to right is constant with the same value. For instance, the following matrix is a diagonal-constant matrix:

A diagonal-constant Matrix

A	B	C	D	E
F	A	B	C	D
G	F	A	B	C
H	G	F	A	B
I	H	G	F	A

Not a diagonal-constant Matrix

A	B	C	D	E
F	A	B	K	D
G	F	A	B	C
H	G	F	A	B
I	H	G	F	A

- a. Write a C++ function that takes, as parameters a 2D matrix and its dimensions and determines, whether it is a diagonal-constant matrix or not by returning true or false.

- b. Write another C++ function that takes as parameters a 2D matrix and its dimensions and it writes its data in a file "Output.txt", if it is a diagonal-constant matrix, output format is given below.

Output - Notepad

File Edit Format

```
e
d, d
c, c, c
b, b, b, b
a, a, a, a, a
f, f, f, f
g, g, g
h, h
i
```

- c. Write a C++ function that takes as parameters a 2D matrix and its dimensions and rotates the matrix in anti-clock wise direction, if it is a constant diagonal matrix.

A diagonal-constant Matrix

A	B	C	D	E
F	A	B	C	D
G	F	A	B	C
H	G	F	A	B
I	H	G	F	A

After Rotation

B	C	D	E	D
A	A	B	C	C
F	F	A	B	B
G	G	F	A	A
H	I	H	G	F

