Set 1 - Introductory:

1. Write a program that reads in the radius of a circle and prints the circles diameter, circumference, and area. Use the constant value 3.14 for π.

2. Suppose electricity costs 6.72 cents per kwh and state tax of 8% is added. Write a program that accepts the number of kilowatt hours and calculates the bill.

3. Write a C program that enters three integers from the user and prints them in the reverse order.

4. Write a C program that inputs two integers and determines:

a- The sum.
b- The product.
c- The difference.
d- The quotient of division.
e- The remainder of division.

Set 2 – if/else Statement:

1. Write a C program that enters a float number representing the grade of a student and print out whether the grade is pass or fail (pass → Grade >= 60)

2. Write a C program that changes the temperature from Fahrenheit to centigrade. The program should ask the user to enter the temperature in Fahrenheit.

(Hint: use the formula C=(5/9)*(F-32))

3. Write a program that accepting the pair non zero coordinates X & Y print the number of the quadrant in which the point (X, Y) lines.

4. Write a program which input three numbers and output the message "sorted" if the numbers are in ascending order and output "not sorted" otherwise.

5. Write a C program that inputs an integer and tells the user whether this integer is even or odd.

6. Write a program that will ask the user to enter a number between 1 and 5 using the if --- else statement and print the name of the number (for example print two if the user entered 2).

7. Write a C program that prompts the user to input the temperature in degrees centigrade. Then the program should print "Freezing" if the temperature is less than zero, "Clear" if the temperature is between 10 and 25, "TOO HOT" if the temperature is above 40, and "Out of range" otherwise.

8. Write a program that solves for a Quadratic equation:

$ax^2 + bx + c = 0$

(Hint: delta=b2 –4*a*c)

The program should tell if we have no or single or two distinct roots.

9. Write a program that inputs the total number of hours and the salary per hour for an employee and calculates his salary. If the number of hours is greater than 40, then the salary per hour for the extra work should be doubled.

Set 3 – Nested if/else and Switch Statement:

1. Given Ohms law V = I*r. Develop a C++ program that prompt the user to press 1 to calculate the voltage, 2 to calculate the current, 3 to calculate the resistance. If user presses any other number print wrong choice. Then calculates the appropriate parameter by inputting the other two. For example, if the user enters 2, then the program should ask for V and R and calculates I.

2. Write a program that prompts the user to input a choice to determine one of the followings. (Use the switch statement)

a) The area of a circle. A = pi*R2
b) The surface area of a cylinder. A = 2*pi*R*L
c) The volume of a cylinder: Vc = pi*R2*L
d) The volume of a sphere. Vs = (4/3)*pi*R2

Hint: Make your program case insensitive.

3. Repeat problem 2 but using a nested if/else statement.

Set 4 - Loops:

1. Write a C++ program that prints all numbers from 1 up to 50 using the While structure.

2. Write a C++ program that enters characters and count the occurences of A, B, C and D. use special character to end the program.

3. Write a C++ program that inputs two numbers and determine the sum of all even numbers bounded by these two numbers.

4. A certain program will print a very important message only if the user knows the secret letter (suppose the letter "s" small or capital). The program prompts the user to enter a letter. It prompts five times or until the code is correct whichever comes first. Write such a program.

5. Write a program that computes the average of a class, where the number of students in the class is entered by the user. Modify the above program so that it determines the maximum and the minimum grades of the class.

6. Write a C program that finds the factorial of a number using do/while structure. .(use the following formula)

$$X! = 1*2*3*\ldots.*X$$

7. Write a program that determines the approximate value of the PI using the following series:

$$Pi = 4 – 4/3 +4/5 – 4/7 + 4/9 – 4/11 + \ldots$$

Set 5 – Nested Loops:

1. Write a C++ program that prompts the user to input a number to check whether the number is perfect or not. The program should ask the user to input a special character (Example: -1) to end the program, otherwise the program will restart again. Ex: 6 is perfect since the sum of its divisors (1+2+3) is equal to the number itself.

2. Write a C++ program that provides the user with a set of options:

a) Find the factorial of a number.
b) Calculate the maximum of 10 integers.
c) Check for a number whether it is prime or not.
d) Determine the power of two numbers xy.
e) To exit the program.

The program should repeat the list of options if the user enters an invalid option. (Use switch statement).

3. Write a program that computes the following function:

$$Sinch(x) = (e\ x – e\text{-}\ x\ ) / 2.$$

Hint: use the following series to determine the exponential ex:

(use a loop to include only the first 50 elements of the series)

$$ex = 1 + x/1! + x2/2! + x3/3\ ! +\ldots..$$

4. Write a program that determines the Lowest Common Multiple (LCM) of three integers.

5. Write a C++ program that prints the following output. (Use nested loop).

6. Write a program that is used to transfer a given number from its decimal notation to its binary notation.

Set 6 - Functions:

1. Write a function that determines whether a number is prime or not. Use this function to find all prime numbers between 2 and 1000.

2. Write a program that uses a function that takes two integers as arguments and returns the greatest common divisor (GCD) of these numbers. Use this function to find the GCD of two numbers entered by the user.

3. Write a program that uses four functions:

a) void square(int x) to draw a square of side x.
b) void triangle(int x) to draw a triangle of side x.
c) void rectangle(int x, int y) to draw an x by y rectangle.
d) void parm(int x, int y) to draw an x by y parm.

4. Write a function that calculates the cube of an integer. Use it to calculate the sum: cube (1) + cube (2) + …+ cube (x), where x is a number entered by the end user.

5. Write a program that uses a function that takes the time as three arguments: hour/minute/second. The function should return the total number of seconds in that time.

6. Write a function that checks for an integer if it is prime or not. The function should return true if the number is prime and false otherwise.

Set 7 - Arrays:

1. Write a program that enters 10 integers from the user, store these integers in an array and prints them in the output screen in the reverse order (backward).

2. Write a program that inputs 9 characters from the user and store them in an array. Then search in this array for a key character entered by the user, if the character is found, the program should specify the index of the element in the array.

3. Write a program that inputs 8 integers and sort them in a decreasing order.

4. Write a program that inputs a set of integers and then find the following:

a) The mean.

b) The median.
c) The mode.

5. Write a program that inputs the grades of 15 students and find the average of this class, the maximum grade of the class, and the minimum grade of the class using array.
(Use separate functions for the max. and min.)

Set 8 – Multi-dimensional Arrays:

1. Write a program that finds the transpose of a square matrix, the user should enter the elements of the matrix and the program should print them in the transpose form. For example:

$$M = \begin{matrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{matrix} \quad \text{then} \quad MT = \begin{matrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{matrix}$$

2. Use the program of problem 1 to determine the inverse of a square matrix.
Hint:

$$\text{If } M = \begin{matrix} A & B & C \\ D & E & F \\ G & H & I \end{matrix}$$

Then: $M\text{-}1 = (1/\text{delta})*MT$

Where: $\text{Delta} = A*(E*I-F*H)-B*(D*I-F*G)+C*(D*H-E*G)$

3. Write a program that initialize a 2-dimentional array with the following data, and finds the average of each of the students:

	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Student# 1	77	25	91	71	68
Student# 2	90	60	28	82	89
Student# 3	50	70	38	98	85

a) Write function that determines the average of the class in each of the grades.
b) Write two functions to return the maximum and the minimum grades of the above table.

Set 9 – Pointers:

1. Write a program that uses a function to find the maximum of three integers using call by reference.
2. Write a program that calls a function to swap two characters and print them in the new form using call by reference.

3. Write a program that calls a function to input the elements of an array of size 10, and print them from the main.
4. Write a program that sorts the elements of an array using the following function:

Void sort (int *ptr, int size).

5. Write a function that uses pointers to calculate the array C that is equal to the sum of the arrays A and B that are of the same type and size N (C[k]=A[k]+B[k]). All arrays must be stored in the heap. The function prototype is:

Void copy (int *A, int *B, int *C, int N)

6. Modify this prototype by specifying constant pointers and/or data when appropriate.
7. Write a function that uses pointers to copy an array A into an array B in reverse order (the first element of A is assigned to the last element of B, etc…). The two arrays have the same type and size N and stored in the heap. The function prototype is:

Void copy (int *A, int *B, int N)

8. Modify this prototype by specifying constant pointers and/or data when appropriate.

Set 10 – Strings/Arrays/Pointers:

1. Write a program that will read a sentence containing several percent sign characters (%) and substitute the word percent for each of them.
For example: 50% → 50 percent

2. Write a program that will sort a given string in alphabetic order.

For example: g d j b p o k a z x → a b d g j k o p x z

3. Write a program that will convert the case of a string.

For example: Welcome EVERYBODY! → wELCOME everybody!

4. As a software developer, you were asked to create a prototype program that can manage a bookstore. The program must be sub-divided into a set of functions where each function performs a specific task. Assume that we have the following data to be stored about each of the books in the bookstore.

	Business	Management	Mathematics	Engineering	English
Arabic	2	2	1	5	6
English	4	7	8	5	4
French	5	9	6	7	4
Spanish	1	5	8	7	3

This table contains the number of books in the store (we have 2 business books written in Arabic language, and so on). Another table contains the prices of each of the books as shown below:

	Business	Management	Mathematics	Engineering	English
Arabic	1200	800	750	950	700
English	1300	750	750	700	960
French	1100	820	780	630	500
Spanish	1000	900	760	860	650

The followings are the requirements of the program:

1. A function that explains the purpose of the program and gets a choice from the user.
2. A function that initializes two 2-dimentional arrays, namely books [ ][ ] and prices [ ][ ].
3. A function that returns the price of a book by specifying the indices of the book in the array.
4. A function that checks whether a book exists in the store or not.
5. A function that calculates the total price of the collection of books. Notice that if a book is delivered to a customer, then the corresponding count of the books array should be decremented. If the number of books is zero, then the program must tell the user that the book is not available.
6. A function that prints a table showing the number of books available and the corresponding prices.