C Programming Practice Exercise 1.

1) Write a program that accepts three numbers and computes their sum, product and average.
2) Write a program that accepts the radius of a circle and computes both it's area and circumference.
3) Write a program that accepts the width and length of a rectangle and computes both it's area and perimeter.
4) Write a program that computes the area of a right-angled triangle.
5) Write a program that accepts measurements in cm and converts them into metres. If someone enters 200 for example, the output should take the form;

   200 cm = 2 metres.
6) Write a program that accepts temperature in degrees Celsius and converts and outputs it in degrees Fahrenheit.
7) Write a program that accepts distance traveled in metres and the time taken in minutes and then outputs the speed in kilometers per hour (km/h). E.g. if someone enters a distance (in metres) of 500 and a time (in minutes) of 15 the output for speed should be 2 km/h.
8) Write a program that accepts measurements in kilometers and the converts and displays them in metres. E.g. if someone enters 0.4 (kilometers) the output should take the form **0.4 kilometers = 400 metres.**
9) Write a program that accepts the weight of a package in grams and then converts it to kilograms and also specifies how many such packages form one kilogram. For example, if the user enters the weight (in grams) of the package as 100, the output should be;

   The weight of the package is 0.1 kilograms.
   It takes 10 such packages to form one kilogram.
10) Write a program that accepts the age of a person, if the person is 18 and above, it should print **You can vote.** otherwise it should print **You are too young to vote.**
11) Write a program that accepts a number and then outputs it's square, cube, square root and cube root.
12) Write a program that prints **God bless Kenya.** 25 times on the screen using: -
    a) do…while loop.
    b) while… loop
    c) for… loop.

    NB: The Phrase *God Bless Kenya* should appear **only once** in your source code.

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C Practice Exercise If and Switch (Set I).

1) Write a program that when run, produces a menu showing beer brands and their prices and then prompts the user enter his/her choice (1,2,3 or 4). The user is then asked how many bottles he/she wants. He is then given the total cost (depending on the cost of the beer chosen) as the output. See sample dialog below. If he/she enters an invalid choice e.g. 8, he/she should get an error message.

Sample dialog

```
* * * * Jamal and Daughters Pub * * * *

Beer Brand          Price

1) Tusker           100/=
2) Pilsner          120/=
3) Smirnoff Ice     140/=
4) White Cap         90/=

Enter your choice: 2
How many bottles of pilsner do you want? 11
11 bottles of pilsner will cost you Kshs. 1320
```

   a) Use the if…else statement
   b) Use the switch statement.

2) Write a program that prompts the user for two numbers. The program then prompts the user for the operator (+, - , * , / or %). The user is the given the answer depending on the operator entered. If he enters an invalid operator, he/she should get an error message. See sample dialog below.

Sample Dialog

```
Enter two numbers: 12 15
Enter an operator: +
12 + 15 = 27
```

   a) Use the if…else statement
   b) Use the switch statement

3) Write a program using the tax information below: -

Gross Pay	**Tax Rate**
Over 40,000	30%
>= 30,000 but below 40,000	25%
>=20,000 but below 30,000	15%
>=10,000 but below 20,000	10%
Below 10,000	no tax.

   Write a program that accepts the gross pay and computes both the tax amount and the net pay. (Assume the net pay is gross pay – tax amount)

4) Write a program that prompts the user for two numbers and then computes them using the following rules. If the first number is greater than the second one, the second number is subtracted from the first one. If the second number is greater than the first one, the first number is divided by the second one. Otherwise the two numbers are added.
5) Write a program to read a value from the keyboard and output the phrase NEGATIVE if the number is negative, POSITIVE if the number is positive or ZERO otherwise.
6) Write a program that accepts two numbers and divides the bigger number by the smaller number and displays the results. The program should display an error message (and not perform the calculation) if the smaller number is zero.
7) Write a program that computes the area & perimeter of **either** a rectangle, a circle or a right-angled triangle. The program should display a menu that enables the user to select the type of figure whose area & perimeter he/she wants to compute. Depending on the users choice, the program should prompt for the dimensions and perform the computations. The output should be: - The type of figure, the dimensions, the area and the perimeter. (**NB:**The calculation should be for **only one** figure at any one time.)
8) Write a program that can be used by a policeman to determine if a vehicle has exceeded the speed limit and to levy a fine. The policeman should enter the vehicles speed and the speed limit. If the speed limit is exceeded by less than 30kph a fine of Kshs. 2500 should be charged. Otherwise a fine of Kshs 4000 is charged. Your program should then output (in a suitable format) the vehicle speed, the speed limit, the excess speed and the fine levied.

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C Programming Practice If and Switch (Set II).

1) Write a program that accepts an integer and checks whether it is even or odd and then prints an appropriate message.

2) In a certain organization, people are taxed using the following tax bracket.

Salary	Tax rate
>= 20000	15%
10000 – 20000	10%
0 – 10000	Not taxed

Write a program that accepts someone's salary and computes both their tax amount and net salary (Gross – tax)

3) In a certain organization, employees are taxed depending on their gender and amount of money they earn. The criterion is shown below.

Employee	Tax Rate
Female earning < 15000	12%
Female earning >= 15000	14%
Male earning < 14000	13%
Male earning >= 14000	15%

a) Write a program to implement the above.

4) The value of y is calculated as follows:-

$y = 4x^3 + 2x - 6$ when $x > 5$
$y = 3x^2 - 4y + 12$ when $x < 5$
$y = 6x - 5$ when $x = 5$

Write a program that accepts the value x and then computes the value of y.

5) In the Jomo Kenyatta University Diploma program, a student takes five units each semester. The student is then graded using the following criteria: -

Average Mark	Order of Merit
75 – 100	Distinction
65 – 75	Credit
50 – 65	Pass
0 – 50	Fail.

Write a program that accepts marks scored in five subjects and then computes the average and prints the order of merit based on the average mark.

6) A number is said to be evenly divisible by 9 if it is divisible by 9 and at the same time it is even. For example 18 is evenly divisible by 9 but 27 is not. A program is required that accepts an integer and checks whether it is evenly divisible by 9 or not and then prints an appropriate message.

7) Write a program that accepts an integer and checks whether it is positive, negative or zero and then prints an appropriate message.

C Practice Exercise (Loops).

1) A program is required that computes the square and cube of all numbers between 2 and 10 and display them using a loop. The output should take the following format.

Number	Square	Cube
2	4	8
3	9	27
…		
10	100	1000

Write the program using: -
a) do…while loop
b) for… loop
NB: The program has no input.

2) Write a program that accepts a list of integers and computes their sum. The program should allow the user to enter any number of integers but an input of zero should terminate the list. For example if the user enters 2 5 6 12 8 2 0 the sum should be 35. If he/she enters 2 4 5 0 the sum should be 11 and if he enters 5 4 6 0 12 43 2 the sum should 15 i.e. only numbers before zero are summed. The rest are ignored and the program terminated.

3) Write a program that computes the sum of the squares of the first 15 positive integers and display the results using
a) while… loop.
b) for… loop.

4) Write a program that accepts a number and prints out it's reciprocal (1/n). The program should prevent the user from entering zero by asking the user to enter the value again. After being given the answer, the user should be asked if wants to continue by entering 'c' to continue and 'x' to exit.

5) Write a program that displays all numbers divisible by 8 between 1 and 200 using
a) do…while loop
b) for… loop

6) Write a complete program that will read the three values for Deposit, interest rate and number of years an amount of money is being saved. Your program should the compute the cumulative **compound** interest over the given period of years. **NB:** Don't use the formula for calculating compound interest. Use loops instead. For example, if the deposit is 10000 and the interest is 10 percent and the money is being saved for ten years, the output should take the format shown below (including number of decimal places)

Year	Interest	Balance
1	1000.00	11000.00
2	1100.00	12100.00
3	1210.00	13310.00
….		
10	2357.94	25937.42

The compounded interest for 10 years is Kshs. 15937.42

The balance in the account after 10 years at 10.00 percent interest is Kshs. 25937.42

7) Write a program to produce the following multiplication table using loops.

```
*   1   2   3   4   5   6
1   1   2   3   4   5   6
2   2   4   6   8  10  12
3   3   6   9  12  15  18
4   4   8  12  16  20  24
5   5  10  15  20  25  30
```

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Nested Loops Exercise

Making use of Nested Loops (Only two [nested] loops per program) write code to give the following output.

a) Do all the questions using nested for… loops.

b) Repeat questions 1 to 5 using nested do…while loops

c) Repeat questions 6 to 10 using nested while… loops

1) Question One

```
1
1  2
1  2  3
1  2  3  4
1  2  3  4  5
```

2) Question Two

```
1  2  3  4  5  6
   2  3  4  5  6
      3  4  5  6
         4  5  6
            5  6
               6
```

3) Question Three

```
2
3  4
4  5  6
5  6  7  8
6  7  8  9  10
```

4) Question Four

```
2  3  4  5  6
3  4  5  6  7
4  5  6  7  8
5  6  7  8  9
6  7  8  9  10
```

5) Question Five

```
*
*  *
*  *  *
*  *  *  *
*  *  *  *  *
*  *  *  *  *  *
```

6) Question Six

7) Question Seven

8) Question Eight

9) Question Nine

+	10	20	30	40	50
60	70	80	90	100	110
55	65	75	85	95	105
50	60	70	80	90	100
45	55	65	75	85	95
40	50	60	70	80	90
35	45	55	65	75	85
30	40	50	60	70	80

10) Question Ten

*	1	2	3	4	5	6	7
10	10	20	30	40	50	60	70
20	20	40	60	80	100	120	140
30	30	60	90	120	150	180	210
40	40	80	120	160	200	240	280
50	50	100	150	200	250	300	350

C# Practice Exercise (Classes)

1) i) Define a class that has the following specifications:
   Private member variables:
   - Name (an array of characters)
   - Mark (an integer)
   - Grade (a character)
   - Reg_No (an array of characters)

   Public member functions:
   - input – to be used to input values into member variables.
   - display – to display contents of member variables.
   - A constructor to be used to initialize member variables. (6 mks)

   ii) Declare two objects of the class defined above and initialize them with values. (3mks)

   iii) Write C# statements that use the objects defined (ii) above to call the two functions input and display defined in (i) above. You need not write the whole program. (3 mks)
2) Write a program that will make use of a class called **Credit** to determine if a department store customer has exceeded the credit limit on charge account for each customer, the following facts are available:
   - Account Number.
   - Balance at the beginning of the month.
   - Total of all items charged by this customer this month.
   - Total of all credits applied to this customer account this month.
   - Credit Limit.

   The program should input each of those facts, calculate balance (= beginning balance + charges – credits) and determine if the new balance exceeds the customers credit limit. For those customers whose credit limit is exceeded the program should display the message "Credit Limit Exceeded" otherwise the message "Within the credit limit" should be displayed. The program should include a loop that lets the user repeat this calculation until he or she is through. NB: 1) The computations should be done for a customer at a time. 2) Assume that the user doesn't know exactly how many customers he's going to work with when he is starting. So don't ask him/her "How many customers…" (14 mks)
3) Create a C# class for 'Bank Account' abstract data type. It should have the attributes account number (integer), account holder (string) and current balance (float). Define methods to get and set account numbers and account holders (total = 4). Add a method, which will return the account holder's current balance. Finally, add two methods, which allow deposit and withdrawal of money updating the current balance as appropriate. NB: Don't add any other methods (member functions)
   Using the 'Bank Account' class above, write a program to test these methods as follows: -
   i) Create three bank accounts, two to start with balances 0.00 and one with 2,000.
   ii) Set the account numbers to 101,102 and 103 respectively.
   iii) Set names of account holders.
   iv) Credit (deposit) account 101 with 2,000.00 and account 102 with 1,750.00.
   v) Debit (withdraw) account 103 with 1,250.00

vi) Display the account numbers, account holders and current balance for the three accounts. (16 mks)

4) Create a C# class for a rectangle abstract data type.
   - The class has attributes length and width each of which defaults to 1.
   - It has a member function that calculates the perimeter of the rectangle and another one that calculates the area.
   - It has set and get functions for both length and width. (9 mks)
5) Write a program that makes use of the inheritance concept. The program should consist of only two classes; the base class and the derived class. **NB:** Don't repeat the programs in the notes. (10 mks)
6) You have been appointed the chief IT manager of Housing Finance Corporation. At the moment, the operations are manual and the management would like you to automate them.
   Assume the following details:
   - Employees Names
   - Box Number
   - Town
   - Personnel Number
   - Department
   - Basic Salary
   - Consolidated Allowances

   Required:
   i) Write a C# class declaration for the above. (6 mks)
   ii) Write appropriate function definitions. (5 mks)
   iii) Write the appropriate driver program (main function). (4 mks)
7) There have been too many complains from the JKUAT IT center that the current systems which are procedural oriented are not meeting the evolving changes in the institution. The management would like a demo on how to manipulate employee information.
   Assume the following information:
   - Names of Employee.
   - Personnel numbers.
   - Gender.
   - Department.
   - Salary.

   The management would like an object-oriented program that manipulates the above information together with the following additions:
   That managers draw the following benefits
   - Car loan.
   - House Allowance.
   - A trip to a country of ones choice.

   Required:
   Using the concept of inheritance whereby the *Manager* inherits from *employee* information: -
   - Write the relevant base class and derived class (6 mks)
   - Write the relevant member functions (10 mks)

- Write a driver program. (4 mks)

8) i) Define the term **instantiation**. (2 mks)
   ii) Suppose there is a base class B and a derived class D derived from B. B has two public member functions b1( ) and b2( ), whereas D has two member functions d1( ) and d2( ). Write class definitions for these classes for the following different situations when an object of class D is used:
   a) Neither b1( ) nor b2( ) should be accessible in **main( )**
   b) Both b1( ) and b2( ) be accessible in **main( )** (6 mks)
9) i) Create a class called **Triangle** that stores the length of the base and height of a right-angled triangle in two instance variables. Include a constructor that sets these values. Also include a default constructor. Define two functions. The first is **hypot( )**, which returns the length of the hypotenuse. The second is **area( )**, which returns the area of the rectangle. (8 mks)
   ii) Write an appropriate driver program for the class created above. (4 mks)

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Repeat the following questions using the concept of Object Orientation.

Exercise 1/Introduction

Questions 2 to 9

If Set I

Questions 1, 3, 7 (requires several classes) and 8

If Set II

Questions 3 and 5

3. set and return the width and length

4. set and return the base and height

5. make metres readonly

6. set and return the celsius and make fahrenheit readonly

7,8,9 decide properties you will set

In all those programs, each should have at least one property, a constructor and a default constructor.

C# Practice Exercise (Classes Contd.)

1) Consider a used-car yard in downtown Nairobi called Makokha Car Sales that needs to store details of the vehicles they have in stock. For each vehicle we need to store the following:
   - Registration number
   - Make
   - Distance traveled in Km
   - Buying price (In kshs)
   - Selling price (In kshs)
   - Name of the previous owner

   Write a C# program that uses a class named **UsedCar** and inputs the details for all 30 vehicles in the yard. The program then outputs the details of all vehicles with selling prices between kshs. 400,000 and kshs. 1,000,000. (14 mks)
2) A library requires a program to capture and store details about books in the library. For each book, the following is captured:
   - ISBN
   - Author
   - Title
   - Number of pages
   - Price (in kshs.)
   - Year of publication

   Write a C# program that uses a class named **Book** and that reads the details about all books in the library. The program should then output details for all books whose price is greater than kshs. 3500 and whose number of pages are more than 400. (20 mks)
3) A program that uses a class definition of a class called **Accounts** is required to process a corporations account records and to select a list of problem accounts. The generalized list is then brought to the attention of the comptroller through a printed report.

   Processing Requirements

   Read the following customer records through the key board
   - Customer Name
   - Customer Account number
   - Amount Owed (in kshs.)
   - Days Overdue

   Determine if the record is a problem account. An account is considered a problem if the amount owed is over kshs. 20,000 or the account is more than 30 days overdue

   Display the name of customer and associated information (account number, amount owed and days overdue) of all problem accounts in a suitable format.

   Write the program. NB: The user should decide how many customer/accounts he wants to work with at any particular time. (20 mks)
4) The following details of buses for Kenya Bus Services are stored: *RegNo, FuelCapacity* and *AxleWeight.* Write a program that uses a class called **Buses** to store the details given above. The program should include:
   - Declaration of the class
   - Declaration of an array instance of the class called *Express* of size 67.

- A function definition for a member function to input the details of the 67 buses Express buses.
- A function definition to output the details input above.
- A **main()** function to test the class definition above. (14 mks)

5) Using relevant examples to show how each is done, explain each of the following concepts: -
   i) Private Inheritance.
   ii) Public Inheritance. (6 mks)

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Hint: Where the question asks for many items e.g. 67 buses, 30 vehicles etc. you can modify your program **during testing** [on the computer] to work with fewer items say 3 to reduce data entry. Once you are satisfied with the program you can change it back to the required number.

JAVA Practice Exercise (Arrays).

1) Write a program that accepts the noon temperature in degrees Celsius for each day of the week and then reports the weeks average temperature as well as the hottest and the coolest days.
2) Write a program that accepts a set of marks and then computes the average mark, counts the number of failing (Those below 50) and passing marks (>=50) and also gets the highest and the lowest marks. NB: The user should decide how many marks he/she wants to work with.
3) Write a program that accepts marks (of type double) in five subjects and stores them in array. The program should then output the marks along with their sum and average.
4) A fibonacci series is defined as follows:-
   Fb[0] = 0
   Fb[1] = 1
   Fb[i] = Fb[i – 1] + fb[i – 2] for i >= 2
   Write a program that generates the first n (the user decides how many) fibonacci terms and prints them. The program should also print their sum. (Use array(s))
5) Using Array(s) write a program that generates the multiplication tables of 1 to 10. No input required.
6) Write a program that stores and evaluates the total cost for items bought from a supermarket. The cashier should enter the following: - Product code, Price and Quantity. The total price should be evaluated as follows: -
   Total cost = Price * Quantity
   NB: The cashier should decide ho many Items he/she wants to work with. If he/she chooses 3, for example, the output should take the format shown below.

Item Code	**Price**	**Quantity**	**Total Cost**
109	500	4	2000
201	100	8	800
127	50	10	500

7) i) Write a statement that declares an array named **test** of size 5 and initializes it with 5 floating-point values of your choice. (3 marks)
   ii) Write a segment of code that increments each of the elements of the array defined above by 2.0. (3 marks)
   iii) Write a code segment of code that outputs the new values of the array defined in (i) above and modified in (ii) above correct to 2 decimal places. (3 marks)
8) Write a program that accepts a series of integers (the user should decide how many) and stores them in an array. The program should then pass these values one at a time to a function called even which returns 1 if the number is even and 0 if the number is odd. The main function should then print the output as follows: -
   If the user choose to work with four integers and entered 23,4,90 and 71, the output should be;
   23 is an odd number
   4 is an even number
   90 is an even number
   71 is an odd number
9) a)

i) Declare a two dimensional array and initialize it with values. (3 marks)
ii) Write a loop that computes the mean of the values stored in the array in (i) above (4 marks)
iii) Write an output statement that outputs the last element in the array above.(1 mark)

b) Write code segments to do each of the following.

i) Initialize each of the 5 elements of the integer array **numbers** with 20. (2 marks)
ii) Add 5 to each of the 30 elements of the integer array **values**. (2 marks)
iii) Print the 20 values of the integer array **marks** in column format. (2 marks)
iv) Read the 15 values of the floating-point array **scores** from the keyboard (2 marks)

10) a) Write a program that uses a two dimensional array to compute and display the addition table shown below:

*	1	2	3	4	5	6
1	2	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24

b) Repeat the above question using two one dimensional arrays.

** * * * * All the best – John Maina * * * * **