01. Read four integer values a, b, c and d from the terminal and evaluate the ratio of (a+b) to (c-d) and print the result, if c-d is not equal to zero. For example, a = 12, b=23, c= 34 and d = 45 Ratio = -3.181818
02. Write a program to find the largest value of three numbers.
03. A commercial bank has introduced an incentive policy of giving bonus to all its deposit holders. The policy is as follows: A bonus of 2 percent of the balance is given to everyone irrespective of their balance, and a 5 percent of the balance is given to female account holders if their balance is more than Rs. 5000. Write a program to read the name, gender and balance of a customer and calculate the balance after the bonus is given. Give a suitable the output.
04. The following table shows the grading given for students in an academic institute. Write a program to read the student number and the average grade and print the student number and the appropriate grading given to the student. (write two programs one using the if statement the other using the switch statement)

Average mark	Grade
80 – 100 (inclusive)	Honours
60 -79	First Division
50 -59	Second Division
40 -49	Third Division
0-39	Fail

05. An electric power distribution company charges its domestic consumers as follows:

Consumption units	Rate of charge
0-100 (inclusive)	Rs. 5.50 per unit
Next 101-200	Rs. 8.50 per unit
Next 201 - 300	Rs. 14.50 per unit
Next 301 - 400	Rs. 21.50 per unit
Above 400	Rs. 32.50

Write a program to read the customer number and power consumed and print the amount to be paid by the customer.

06. A manufacturing company has classified its executives into four levels for the benefit of certain perks. The levels and the corresponding perks are shown below.

Level	Perks	
	Conveyance allowance	Entertainment allowance
1	1000	500
2	750	200
3	500	100
4	250	0

An executive's gross salary includes basic pay, house rent allowance at 25% of basic pay and the allowances. Income tax withheld from the salary on a percentage basis as follows:

Gross Salary	Tax rate
Gross < 2000	No tax
2000 <= Gross < 4000	3%
4000 <= Gross < 6000	5%
Gross > =6000	8%

Write a program that will read an executive's job number, level number and basic salary and then compute the net salary after withholding the income tax. Note: use symbolic constant for the Perks. (write two programs one using the if statement the other using the switch statement)

07. Write a program that will read the value of x and evaluate the following function.

$$y = \begin{cases} 1 \text{ for } x < 0 \\ 0 \text{ for } x = 0 \\ -1 \text{ for } x < 0 \end{cases}$$

Write separate programs using if statements and the conditional operator.

08. Write a program to compute the real roots of a quadratic equation

$ax^2 + bx + c = 0$

The program should request for the values of the constants a, b, c and print the values of the roots. Use the following rules

(a) No solution, if both a and b are zero

(b) There is only one root if a is zero

(c) There are no roots if b2 -4ac is negative

(d) Otherwise there are two real roots.

09. Write a program to read three integer values from the keyboard and display the output stating that they are the sides of the right-angled triangle.

10. The BMI (Body Mass Index) is universally expresses in kg/m2, resulting from mass in kilograms and height in meters. The BMI cut-offs are presented with an emphasis on health risk in the following table.

Health Risk	BMI (kg/m^2)
Risk of developing problems such as nutritional deficiency and osteoporosis	under 18.5
Low Risk (healthy range)	18.5 to 23
Moderate risk of developing heart disease, high blood pressure, stroke, diabetes	23 to 27.5
High risk of developing heart disease, high blood pressure, stroke, diabetes	over 27.5

Write a program to read the name, mass and height of a citizen, calculate the BMI value and print the appropriate health risk.

11. Write a program to read the values for x and n and evaluate the equation y = xn.

12. Write a program to evaluate the equation p = 2n for n positive and negative. Give the output as follows;

2 to power n	n	2 to power -n
1	0	1.000000
2	1	0.500000
Etc……		

13. Given a number, write a program to reverse the digits of the given number. For example, if the number is 1234 the output should be 4321.

14. Write a program to compute the sum of the digits of a given integer number.

15. The factorial of an integer m is the product of consecutive integers from 1 to m. That is Factorial m = m! = m(m-1)(m-2)……1

16. Write a program that computes and prints a table of factorials for any given number.

17. The numbers in the sequence 1 1 2 3 5 8 13 21 ….. are called Fibonacci numbers. Write a program to print the nth Fibonacci number give the value for n.

18. Write a program to evaluate the investment equation V = P(1+r)n and print the tables which would give the value of V for various combination of the following values of P, r, and n

P : 1000, 2000, 3000, ……., 10,000

r: 0.10, 0.11, 0.12, …….0.20

n: 1, 2, 3……..10

Here P is the principal amount and V is the value of money at the end of n years.

19. A class consists of 50 students, each of whom studies 5 subjects. The grades obtained by each student in each subject are input to a computer, as one line of input per student. Each line consists of the student's name, which is not more than 30 characters long, followed by five grade numbers in the range of 0 to 10. Write a program to read this input and tabulate the student's overall performance which shows each student's name, his overall grade in a vertically aligned column, and a horizontal bar measure of this overall performance. For example:

Saman Perera 7 7 10 6 4

Saman Perera 34 **********

Kanthi Rathnayake 4 7 5 4 5

Kanthi Rathnayake 25 **********

20. An algorithm is to input from the keyboard, a series of at least two numbers. The first number will be a lower limit., and the program is to display on the screen the total of the numbers input after this number which fall above it. A number is not to be included in the total if it is equal to it. The numbers will end with a dummy value of zero. Foe example

Input: 10 6 12 5 10 18 34 20 9 0

Output: 84 (= 12 + 18 +34 +20)

21. Write a program to input from the keyboard, a series of students exam results and to display on the screen whether the student has passed or failed. For each student, the operator will enter the student name followed by four subjects. For a student, to pass, he or she must obtain an average mark of at least 50 for the four subjects. To quit ask the operator to input 'Q' or 'q'.

For the sample data set the output is given

Input: Sunil 40 60 56 70 output: Pass (average 56.5)
Input: Kamani 20 30 35 55 output Fail (average 35.0)

22. Following is the specifications for simulating an automatic stamp vending machine

(a) It should dispense 25, 15 and 10 rupees worth stamps

(b) It should accept 50, 25, 10 and 5 rupees coins.

(c) It can accept not more than one coin for each transaction.

(d) If more than one coin of the same denomination is to be returned as change after dispensing the stamp, the machine cannot do it. Instead the coin should be returned and a 'no change' signal turned on.

(e) The machine should dispense the stamp and the right change and must indicate exceptional cases such as 'insufficient amount tendered', 'no stamp available', 'no change available', etc.

Write a program to simulate the machine. The input to the program would be: Amount tendered and the stamp requested(only one stamp). The output of the program should be whether stamp is dispensed or not, the value of the stamp dispensed, the denomination of the coins returned (if any) and no change signal if no change is returned and no stamp if the stamp is not available.

23. Write programs to print the following outputs using for loops.

```
1          1          *****          *****
12         22         ****            ****
123        333        ***              ***
1234       4444       **                **
12345      5555       *                  *
```

24. Write a program to print the multiplication table form 1 x 1 to 12 x10 as shown below.

MULTIPLICATION TABLE

```
1    2    3    4    5    6    7    8    9    10
2    4    6    8   10   12   14   16   18    20
3    6 ..................................................  30
.
.
12   24   36   48 ..........................................  120
```

25. Write a program to read the age of 10 persons and count the number of persons in the age group 50 to 60. (use continue)

26. Write a program to evaluate a square root of a series of numbers and print the results. The process could be stopped when the number 9999 is typed. In addition to the result (i.e. square root), the total number of items that the square root was calculated, and the total number of negative items entered should be given. (Hint. Use continue if necessary you may use the break as well)

27. Write a program using for loop to print the following output. (Assign the world " CProgramming" to a char array).

C

CP

CPr

.....

CProgrammin

CProgramming

28. Write a program using a single-subscribed variable to evaluate the expressions

$$Total = \sum_{i=1}^{10} x_i^2$$

The value of x1, x2, ... x10 are read from the terminal.

29. Write a program to read a set of characters one by one until the new line and store the characters in an array. Then count the number of occurrences of a specified character (given by the user) in stored line.

30. Given below is the list of marks obtained by a class of 50 students in an annual examination

43 65 51 27 79 11 56 61 82 09 25 36 07 49 55 63 74 81 49 37 40 49 16 75 87 91 33 24 58 78 65 56 76 67 45 54 36 63 12 21 73 49 51 19 39 49 68 93 85 59

Write a program to count the number of students belonging to each of the following group. 0-9, 10-19, 10-19,.....90-99, 100 (i.e. 11 groups).

(Use one array to store the marks another array to store the frequency) Give the output as follows

Group	Range	Frequency
1	0 to 9	2
2	10 to 19	4
.	.	.
10	90 to 99	2
11	100 to 100	0

31. Write a program to find the complement of a binary number. If the binary number is 101 the complement is 010. (Use a char array to read the binary number).

32. In statistics, standard deviation is used to measure deviation of data from its mean. The formula for calculating standard deviation of n items is

$$s = \sqrt{variance} \qquad \text{where} \quad variance = \frac{1}{n}\sum_{i=1}^{n}(x_i - m)^2$$

$$m = \text{mean} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Write a program to read n items (i.e. marks of students) and calculate mean, variance and the standard deviation of the items.

32. A palindrome is a sentence which (Considering only the letters and ignoring all spaces and punctuation marks) reads the same both back-wards and forwards. For example MADAM I'M ADAM. Write a program to read a sentence ending with a full stop and determine whether it is a palindrome or not.

33. Consider the following data table, which shows the value of sales of three items by four sales girls:

	Item1	Item2	Item3
Salesgirl#1	310	275	365
Salesgirl#2	210	190	325
Salesgirl#3	405	235	240
Salesgirl#4	260	300	380

Each row represents the values of sales by a particular salesgirl and each column represents the values of sales of a particular item.

Write a program using a two-dimensional array to compute and print the following information.

(a) Total value of sales by each girl

(b) Total value of each item sold

(c) Grand total of sales of all items by all girls.

34. A survey to know the popularity of four cars (Toyota (code 1) , Nissan (code 2) , Honda (code 3), Maruti (Code 4)) was conducted in four cities (Kandy (code K), Colombo (code C) , Galle (code G) and Matara (code M)). Each person surveyed was asked to give his city and the type of car he was using. The results, in coded form, are tabulated as follows:

```
M 1 C 2 K 1 G 3 M 2 K 4
C 1 G 3 M 4 K 2 G 1 C 3
G 4 G 4 M 1 M 1 K 3 K 3
C 1 C 1 C 2 M 4 M 4 C 2
G 1 C 2 K 3 M 1 K 1 C 2
G 3 M 4 C 1 G 2 M 3 K 4
```

Write a program to produce a table showing popularity of various cars in the four cities. Give the output as

City	Toyota	Nissan	Honda	Maruti
Kandy	2	1	3	2
Colombo	4	5	1	0
Galle	2	1	3	2
Matara	4	1	1	4

35. Write a program to transpose a given matrix.

If the given matrix is

```
1 2 3
4 5 6
7 8 9
```

The transpose is

```
1 4 7
2 5 8
3 6 9
```

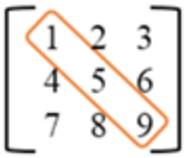
36. A magic square is a square array (i.e. rows and columns are equal) of numbers such that the numbers in each row, column and diagonal have the same sum. Write a program to read a square array and determine whether it is magic square array and give is sum.

Eg

```
4 9 2
3 5 7
8 1 6
```

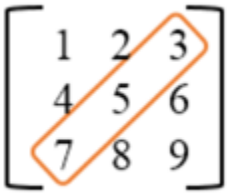
is a square array and sum is 15.

37. Write a C program to read elements in a matrix and find the sum of main diagonal (major diagonal) elements of matrix.



The sum of the main diagonal is 15

38. Write a C program to read elements in a matrix and find the sum of minor diagonal (opposite diagonal) elements.



The sum of minor diagonal is 15

39. Write a C program to read elements in a matrix and interchange elements of primary(major) diagonal with secondary(minor) diagonal.

40. Write a program which reads a sequence of 10 positive integers and then finds the maximum of the sequence, outputs its value, the number of times that it occurs and the position in which it appears. The process is then repeated to find the next largest value and so on.

Input : 7 10 143 10 52 143 72 10 143 7
Output : 143 occurs 3 time at positions 3 6 9
.....
.....
7 occurs 2 times at positions 1 10

Use Structures and if necessary arrays.

41. Define a structure data type called time_struct containing three members integer hour, integer minute and integer second. Develop a program that would assign values to the individual members and display the time in the following format:

16:40:51

42. Write a C program to add two distances entered by user. Measurement of distance should be in inch and feet. (Note: 12 inches = 1 foot)

43. A complex number has a real part and in imaginary part (x + iy). Write a program to read two complex numbers and calculate the sum product and quotient.

$$\text{Sum} = (a + ib) + (c+id) = (a+c) + i(b+d)$$
$$\text{Product} = (a + ib) * (c + id) = ac - bd + i(ad + bc)$$
$$\text{Quotient} = (a + ib)/(c + id) = (ac+bd)/(c^2 + d^2) + i(bc - ad)/(c^2+d^2)$$

44. A shop has different brand of soaps. The shop owner needs a program to store all the soaps that are in the shop. For each soap the brand code, quantity in stock and the price of the brand need to be stored. The owner needs to know the number of brands and the total value of each brand that are in the shop. Write a program for this shop owner. You may choose a suitable way to terminate the program.

45. A small company has about 50 employees. For each employee the name, salary date joined (i.e. year month and day) need to be recorded. It is decided to increase the pay as per the following rules.

Pay <= 10,000	: 15% increas
Pay <= 30000 and < 10,000	: 10% increas
Pay >= 30,000	: no increase

Write a program to read the employee data and increment the salary and print the pay slip.

46. A small college has about 100 students. For each student number, name, department, year of joining is to be recorded. Write a program to do the following:

- Print the names of all students who joined a particular year. (get this year from the user)

- Print the data on a student whose student number is given. (get this from the user).

Use a menu to do this. A sample student data will be

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47. A book shop uses a personal computer to maintain the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher, quantity in hand the month and year. Whenever a customer wants a book, the shopkeeper inputs the title and the author of the book and the system replies whether it is in the list or not. If it is not, an appropriate message is displayed. If the book is in the list, then the system displays the book details and asks for the number of copies. If the requested copies are available, the total cost of the books is displayed: otherwise the message copies not in stock is displayed. Once the books are sold the quantity in hand should be updated.

Write a program to accomplish this task. You may use the following data. You may initialize the variable with this data set.

"Ritchie" " C language" 2565, "PHI", 10, "May", 1977
"Kochan", "Programming in C", 1245, "Hayden", 5, "July", 1993
"Balagurusamy", "BASIC", 1890, "TMH", 0, "January", 1984
"Balagurusamy", "COBOL", 3890, "Macmilan", 25, "December", 18

48.