

Indian Institute of Technology Kharagpur		
Department of Computer Science and Engineering		
CS10003 : Programming and Data Structures (Theory)		
Autumn 2020	Long Test 1 (ALL Q&A)	Marks: 30
Date: 06-Jan-2021 (Wednesday) Time: 09:30pm-10:45pm (75 min)		

Instruction: Share with ONLY Instructors and TAs.

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```

+++++++ Topic-1 ++++++

***** Question - 1.1 *****

1. Write a program that
 - (i) takes a character c as input through the keyboard,
 - (ii) if c is a lower-case English letter, prints the corresponding upper-case letter onto the screen,
 - (iii) if c is an upper-case English letter, prints the corresponding lower-case letter onto the screen,
 - (iv) if c is not an English letter, prints c to the screen.

Sample input and output:

```
Input: d
Output: D
Input: G
Output: g
Input: 2
Output: 2
input: !
Output: !
```

***** Answer - 1.1 *****

```
#include<stdio.h>
int main()
{
    char c;
    printf("Enter a character:");
    scanf("%c",&c);
    if(c>='a' && c<='z')
        printf("%c", 'A'+c-'a');
    else if(c>='A' && c<='Z')
        printf("%c", 'a'+c-'A');
    else
        printf("%c", c);
}
```

```
    return 0;
}
```

***** Question – 1.2 *****

2. Write a program that

(a) First prints the following onto the screen:

Type 1 for Jan, 2 for Feb, 3 for Mar, 4 for Apr:

(b) Then takes in a positive integer from 1 to 4 through the keyboard (assume that no other number is entered),

(c) Then prints the following:

Type the day of the month:

(d) Then takes in a positive integer that corresponds to a valid day of the month entered (example: 30 is not a valid day of Feb but a valid day of Jan)

(e) Then prints out which day of the week that date is. You may print 'Mon', 'Tue', 'Wed', 'Thur', 'Fri', 'Sat' or 'Sun'.

Assume that the year is 2021. You may use the fact that January 1, 2021 is a Friday.

Sample input and output:

Type 1 for Jan, 2 for Feb, 3 for Mar, 4 for Apr: 2

Type the day of the month: 12

Fri

Type 1 for Jan, 2 for Feb, 3 for Mar, 4 for Apr: 4

Type the day of the month: 20

Tue

***** Answer – 1.2 *****

```
#include<stdio.h>
```

```
int main()
```

```
{
```

```
    int month, day, total=0, week, sum;
```

```
    printf("Type 1 for Jan, 2 for Feb, 3 for Mar, 4 for Apr: ");
```

```
    scanf("%d",&month);
```

```
    printf("Type the day of the month: ");
```

```
    scanf("%d",&day);
```

```
    sum=day;
```

```
    switch(month)
```

```
    {
```

```
        case 4: sum+=31;
```

```
        case 3: sum+=28;
```

```
        case 2: sum+=31;
```

```
        default;;
```

```
    }
```

```
    week=sum%7;
```

```
    switch(week)
```

```
    {
```

```
        case 0: printf("Thur"); break;
```

```
        case 1: printf("Fri"); break;
```

```
        case 2: printf("Sat"); break;
```

```
        case 3: printf("Sun"); break;
```

```
        case 4: printf("Mon"); break;
```

```

        case 5: printf("Tue"); break;
        case 6: printf("Wed"); break;
    }
    return 0;
}

```

***** Question – 1.3 *****

Write a program that

(a) takes in four floating point numbers x_1 , x_2 , y_1 and y_2 as inputs through the keyboard,
 (b) prints "Yes" if the line segment joining the points (x_1, y_1) and (x_2, y_2) intersects the line $y=x$, and prints "No" otherwise. You may assume that neither (x_1, y_1) nor (x_2, y_2) lies on the straight line $y=x$.

Sample input and output:

Enter x_1 , y_1 , x_2 , y_2 : 2.2 3 3.4 3.1

Yes.

Enter x_1 , y_1 , x_2 , y_2 : 4.2 3 3.4 3.1

No.

***** Answer – 1.3 *****

```

#include<stdio.h>
int main()
{
    float x1, y1, x2, y2;
    printf("Enter x1, y1, x2, y2: ");
    scanf("%f%f%f%f", &x1, &y1, &x2, &y2);
    if(((y1 > x1) && (y2 < x2)) || ((y1 < x1) && (y2 > x2)))
        printf("Yes.");
    else
        printf("No.");
    return 0;
}

```

+++++ Topic-2 +++++

***** Question – 2.1 *****

Write a program to print all prime factors of an input integer n with repetitions. For example, if the input is 16, then your program should print 2,2,2,2, because $16=2 \times 2 \times 2 \times 2$.

Sample input and output:

Input: 16

Output: 2,2,2,2,

Input: 36

Output: 2,2,3,3,

Input: 500

Output: 2,2,5,5,5,

Input: 7
Output: 7,

***** Answer - 2.1 *****

```
#include<stdio.h>
int main()
{
    int n, i=2;
    printf("Enter a positive integer: ");
    scanf("%d", &n);
    printf("prime factorization of n: ");
    while(n > 1)
    {
        while(n%i==0)
        {
            printf("%d,", i);
            n/=i;
        }
        i++;
    }
    return 0;
}
```

***** Question - 2.2 *****

Let $T(n)$ denote the n -th term in the sequence

1, 1, 1, 3, 5, 9, 17, 31, ...

$T(1)=1$, $T(2)=1$, $T(3)=1$, and each subsequent term in this recurrence is the sum of its preceding three terms.

Write a program that takes in a positive integer n and prints out $T(n)$. Your program should not use array or recursion.

Sample input and output:

Input: 2
Output: 1

Input: 3
Output: 1

Input: 4
Output: 3

Input: 5
Output: 5

***** Answer - 2.2 *****

```
#include<stdio.h>
int main()
{
    int n, a1=1, a2=1, a3=1, temp;
    printf("Enter a positive integer: ");
```

```

scanf("%d", &n);
while((n--)>3)
{
    temp=a1+a2+a3;
    a1=a2;
    a2=a3;
    a3=temp;
}
printf("%d", a3);
return 0;
}

```

***** Question - 2.3 *****

Write a program that takes in through the keyboard the co-ordinates of n vertices of a polygon in clockwise order, and determines if the polygon is regular (i.e., the length of all the sides are equal). Your program should not use array.

Sample input and output:

How many points? 4

Enter x and y co-ordinates of point 1: -1 0

Enter x and y co-ordinates of point 1: 0 1

Enter x and y co-ordinates of point 3: 1 0

Enter x and y co-ordinates of point 4: 0 -1

Regular

How many points? 4

Enter x and y co-ordinates of point 1: 1 1

Enter x and y co-ordinates of point 1: 1 2

Enter x and y co-ordinates of point 3: 1 3

Enter x and y co-ordinates of point 4: 1 4

Not regular

***** Answer - 2.3 *****

```
#include<stdio.h>
```

```
int main()
```

```
{
```

```
    int n,N, sq_dist, flag=0;
```

```
    int startx, starty, x1, y1, x2, y2;
```

```
    printf("How many points? ");
```

```
    scanf("%d", &n);
```

```
    printf("Enter x and y co-ordinates of point 1: ");
```

```
    scanf("%d%d", &startx, &starty);
```

```
    printf("Enter x and y co-ordinates of point 1: ");
```

```
    scanf("%d%d", &x1, &y1);
```

```
    sq_dist=(x1-startx)*(x1-startx)+(y1-starty)*(y1-starty);
```

```
    n-=2;
```

```
    N=n;
```

```
    for(;n>0;n--)
```

```
{
```

```
    printf("Enter x and y co-ordinates of point %d: ", N-n+3 );
```

```
    scanf("%d%d", &x2, &y2);
```

```

    if((x1-x2)*(x1-x2)+(y1-y2)*(y1-y2)!=sq_dist)
    {
        printf("Not regular");
        return 0;
    }
    x1=x2;
    y1=y2;
}
if(sq_dist==(x2-startx)*(x2-startx)+(y1-starty)*(y2-starty))
    printf("Regular");
else
    printf("Not regular");
return 0;
}

```

+++++ Topic-3 +++++

***** Question - 3.1 *****

Write a program that takes in two strings s1 and s2 as inputs (by using scanf with %s as the format specifier), reverses s1, appends it to s2, and outputs the final string using printf with %s as the format specifier. You may assume that the strings are of size at most 100 each. Your program should not use any default string library function.

Sample input and output:

```

Enter S1: tfhfty
Enter S2: 657658769
ytfhft657658769

```

Another sample input and output:

```

Enter S1: love
Enter S2: india
evolindia

```

***** Answer - 3.1 *****

```

#include<stdio.h>
int main()
{
    int i=0, j;
    char s1[100], s2[100], s3[200];
    printf("Enter S1: ");
    scanf("%s", s1);
    printf("Enter S2: ");
    scanf("%s", s2);
    while(s1[i]!='\0')
        ++i;
    --i;
    for(j=0; i>=0; j++, i--)
        s3[j]=s1[i];
    for(i=0; s2[i]!='\0'; i++)

```

```

    s3[j+i]=s2[i];
    s3[j+i]='\0';
    printf("%s", s3);
    return 0;
}

```

***** Question – 3.2 *****

Write a program that takes in n integers between 1 and 100, and prints the most frequent integer. If there are more than one most frequent integers, the program may print any one of them.

Sample input and output:

```

How many numbers? 5
Enter: 2
Enter: 4
Enter: 6
Enter: 2
Enter: 1
The most frequent number is 2

```

```

How many numbers? 6
Enter: 3
Enter: 5
Enter: 3
Enter: 2
Enter: 1
Enter: 2
The most frequent number is 2

```

```

How many numbers? 4
Enter: 6
Enter: 3
Enter: 5
Enter: 9
The most frequent number is 3

```

***** Answer – 3.2 *****

```

#include<stdio.h>
int main()
{
    int A[100],n, j, i;
    for(i=0;i<100;i++)
        A[i]=0;
    printf("How many numbers? ");
    scanf("%d",&n);
    for(i=0;i<n;i++)
    {
        printf("Enter: ");
        scanf("%d", &j);
        ++A[j];
    }
    j=0;
    for(i=1;i<100;i++)

```

```

        if(A[i]>A[j])
            j=i;
        printf("The most frequent number is %d", j);
        return 0;
    }

```

***** Question – 3.3 *****

Write a program that takes in n integers, and another target integer t and checks if there exist two integers amongst the first n whose sum is equal to t. If there is a pair of such integers, the program prints those. If there are more than one such pairs, then the program can print any one such pair. Otherwise the program prints that there is no such pair of integers.

How many numbers? 5

Enter: 2

Enter: 4

Enter: 3

Enter: 3

Enter: -1

Enter target : 1

-1, 2

How many numbers? 4

Enter: 5

Enter: 7

Enter: 2

Enter: -3

Enter t : 13

No such pair of integers

***** Answer – 3.3 *****

```

#include<stdio.h>
int main()
{
    int A[100],n, j, i, t;
    for(i=0;i<100;i++)
        A[i]=0;
    printf("How many numbers? ");
    scanf("%d",&n);
    for(i=0;i<n;i++)
    {
        printf("Enter: ");
        scanf("%d", &A[i]);
    }
    printf("Enter target : ");
    scanf("%d", &t);
    for(i=1; i<n; i++)
        for(j=0;j<i;j++)
            if(A[i]+A[j]==t)
            {
                printf("%d, %d", A[i], A[j]);
                return 0;
            }
}

```

```

    printf("No such pair of integers");
    return 0;
}

```

+++++++ Topic-4 ++++++

***** Question - 4.1 *****

Let A be an integer array of size 100. An integer array B of size 100 is said to hold the cumulative sums of A if for each i between 0 and 99, $B[i] = A[0] + A[1] + \dots + A[i]$. Complete the following program so that after its execution, array B holds the cumulative sums of array A. Define the function CumSum with appropriate parameter and return types, and call CumSum from inside the main with appropriate parameters.

```
#include<stdio.h>
```

```
// Write definition of CumSum
```

```

int main()
{
    int A[100], B[100], i;
    for(i=0; i<100; i++)
    {
        printf("Enter: ");
        scanf("%d", &A[i]);
    }
    /***** CALL CumSum with appropriate parameters *****/
    for(i=0; i<100; i++)
        printf("%d ", B[i]);
    return 0;
}

```

Sample input and output:

```

Enter number of elements: 5
Enter: 1
Enter: 4
Enter: -7
Enter: 6
Enter: 10
1 5 -2 4 14

```

***** Answer - 4.1 *****

```

void CumSum(int A[], int B[])
{
    int i, sum=0;
    for(i=0; i<100; i++)
    {
        sum+=A[i];
        B[i]=sum;
    }
}

```

Then call CumSum(A, B) from the indicated place in the main.

***** Question – 4.2 *****

Let Ispresent be a function that returns 1 if a given integer is present in a given array of size 10, and 0 otherwise. The prototype of Ispresent is as follows:

```
int Ispresent(int Array[], int integer);
```

Write a program that takes in 10 positive integers through the keyboard, stores them in an array, and then uses the function Ispresent to count the number of perfect squares amongst those integers. You may assume that all the elements entered are distinct (that is no two integers are the same). You must use the given prototype definition of Ispresent function (and do not use your own definition).

Sample input and output:

```
Enter: 1
Enter: 2
Enter: 3
Enter: 5
Enter: 7
Enter: 4
Enter: 16
Enter: 25
Enter: 6
Enter: 81
5
```

***** Answer – 4.2 *****

```
#include<stdio.h>
```

```
/*The students are NOT expected to write the following function
definition */
```

```
int Ispresent(int A[], int n)
{
    int i;
    for(i=0;i<10; i++)
        if(A[i]==n)
            return 1;
    return 0;
}
```

```
int main()
{
    int A[10], n, i, sum=0;
    for(i=0; i<10; i++)
    {
        printf("Enter: ");
        scanf("%d", &A[i]);
```

```

    }
    n=A[0];
    for(i=1;i<10;i++)    //compute max element
        if(A[i]>n)
            n=A[i];
    for(i=1;i*i<=n;i++)
        if(Ispresent(A, i*i))
            ++sum;
    printf("%d",sum);
    return 0;
}

```

***** Question – 4.3 *****

Let A and B be two integer arrays of size 10 each. each entry of these arrays is a digit. Interpret the two arrays as 10 digit decimal integers, with A[9] and B[9] holding the least significant digits respectively. Write a function ADD that, given A and B, prints the sum of the 10 digit decimal integers represented by arrays A and B. Note that the sum can potentially be an 11 digit number. The prototype of ADD is as follows:

```
void ADD(int A[], int B[]);
```

Sample input and output:

If A={0,0,0,0,0,0,0,8,2,3} and B={0,0,0,0,0,0,0,2,4,9} are passed to ADD, then ADD should print 1072 or 00000001072. This is because

```

      0000000823
+   0000000249
-----
      0000001072

```

If A={9,9,6,3,0,0,0,4,2,4} and B={7,0,0,0,5,0,0,3,1,0} are passed to ADD, then ADD should print 16963500734 (11 digit). This is because

```

      9963000424
+   7000500310
-----
     16963500734

```

***** Answer – 4.3 *****

```

#include<stdio.h>
void ADD(int A[], int B[])
{
    int carry=0, C[11], sum, i;
    for(i=9;i>=0;--i)
    {
        sum=A[i]+B[i]+carry;
        C[i+1]=sum%10;
        carry=sum/10;
    }
    C[0]=carry;
}

```

```
/* The rest of the function can also be replaced by
for(i=0;i<11;i++) printf("%d",C[i]); */
```

```
    for(i=0;C[i]==0 && i<11;++i);
    if(i==11)
    {
        printf("0");
        return;
    }
    for(;i<11;++i)
        printf("%d",C[i]);
}
```

```
// Students are not supposed to write the main
```

```
int main()
{
    int A[10], B[10], i;
    printf("Enter elements of A.\n\n");
    for(i=0; i<10; ++i)
    {
        printf("Enter: ");
        scanf("%d", &A[i]);
    }
    printf("\n\nEnter elements of B.\n\n");
    for(i=0; i<10; ++i)
    {
        printf("Enter: ");
        scanf("%d", &B[i]);
    }
    ADD(A, B);
    return 0;
}
```

```
=====
=====
```

```
=====
=====
```

```
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```

```
-----
-----
```

```
+++++++ Topic-1 ++++++
```

```
***** Question - 1.1 *****
```

In Indian Railway ticketing system, there is no ticket requirement for kid (age≤5 yrs), ticket price for child (age in between 5 yrs and 10 yrs) is half, for senior citizen (age>60 years) ticket price is 60%. Write a C program that implements age-based quota system.

The program will read age and price of the ticket and will output payable price.

Sample:

Input: 16 720

Output: 720

Input: 4 720

Output: 0

Input: 65 720

Output: 432

Input: 8 720

Output: 360

***** Answer - 1.1 *****

```
#include <stdio.h>
#define KID 5
#define JUNIOR 10
#define SENIOR 60
int main()
{
    int age;
    float price;
    scanf("%d",&age);
    scanf("%f",&price);
    if(age <= SENIOR) {
        if(age <= KID)
            price=0;
        else if (age <= JUNIOR)
            price=price*0.5;
    }
    else
        price=price*0.6;
    printf("Payable price: %6.2f\n",price);
    return 0;
}
```

***** Question - 1.2 *****

Write a C program that will read a key press and will print if it is an upper-case or lower-case English letter (A to Z and a to z) or digit or none.

[Hints: ASCII value of '0' is 48; 'A' is 65; 'a' is 97]

Input: a

Output: Character

Input: 9

Output: Digit

Input: &

Output: None

***** Answer - 1.2 *****

```
#include <stdio.h>
```

```

int main()
{
    char ch;

    ch=getchar();

    if(ch>='0' && ch<='9') {
        printf("Digit\n");
    } else if((ch>='A' && ch<='Z') ||( ch>='a' && ch<='z')) {
        printf("Character\n");
    } else {
        printf("None\n");
    }
    return 0;
}

```

***** Question – 1.3 *****

In India a freight train can be of length 1.5km. Such a train crosses a station with a uniform velocity.

Write a C program that will read length of the station (in meter) and the time (in seconds) required by the train to cross the station completely and print the velocity (in kilometer/hour) of the train with which it crosses the station.

[Hint: Velocity=Length/Time]

***** Answer – 1.3 *****

```
#include <stdio.h>
```

```

int main()
{
    float length,time;

    scanf("%f",&length);
    scanf("%f",&time);

    length=(length/1000)+1.5;
    time=time/3600;
    printf("Velocity: %8.2f",length/time);
    return 0;
}

```

+++++++ Topic-2 ++++++

***** Question – 2.1 *****

An integer is a perfect cube if its cube root is also an integer. Write a C program to print how many odd and how many even perfect cubes are there between 1 and N, where N is read from the user.

[Example of perfect cube 8 (as $2 \times 2 \times 2 = 8$), 27 (as $3 \times 3 \times 3 = 27$), 64 ($4 \times 4 \times 4 = 64$); odd perfect cube 27, even perfect cube 8 and 64]

Samples:

Input: 70

Output: 2 odd and 2 even perfect cubes

Input: 150

Output: 3 odd and 2 even perfect cubes

***** Answer - 2.1 *****

```
#include <stdio.h>
int main( )
{
    int i,N,cOdd,cEven;
    printf("Enter a number: " );
    scanf("%d",&N) ;

    cOdd=0;
    cEven=0;
    for(i=1;i*i*i<=N;i++) {
        if(i%2==1) {
            cOdd++;
        }
        else {
            cEven++;
        }
    }
    printf("%d odd and %d even perfect cubes\n",cOdd,cEven);
    return 0;
}
```

***** Question - 2.2 *****

Write a C program that will read a string (consisting of lowercase English letters only) and will print the number of vowels in the string.

For example,

Enter a string in lowercase: indian

Output: 3

***** Answer - 2.2 *****

```
#include <stdio.h>

int main()
{
    int i,count=0;
    char input[100];

    printf("Enter a string in lowercase: ");
    scanf("%s",input);
    i=0;
    while(input[i]!='\0') {
        if(input[i]=='a' || input[i]=='e' || input[i]=='i' || input[i]=='o' ||
```

```

input[i]=='u')
    count++;
}
printf("Output: %d\n",count);
return 0;
}

```

***** Question – 2.3 *****

Integer factorization of a number is breaking down the number into the set of integer numbers (excluding 1 and the number itself). Write a C program to print all the integer factors of an integer N (to be read from the user).

Input: 12

Output: 2 3 4 6

Input: 35

Output: 5 7

***** Answer – 2.3 *****

```

#include <stdio.h>
int main()
{
    int i,N,M;
    printf("Enter a number: " );
    scanf("%d",&N) ;

    j=-1;
    M=N;
    for(i=2;i<N;++){
        if(M%i==0){
            j++;
            printf("%d ",i);
        }
    }
    return 0;
}

```

+++++++ Topic-3 ++++++

***** Question – 3.1 *****

Write a C program which,

- 1) reads marks of N (to be read) students obtained in the PDS course (out of 60),
- 2) re-scales the marks out of 100,
- 3) stores the re-scaled marks in an array.

Input: 4

54 30 45 22

Output:

90 50 75 36.7

***** Answer – 3.1 *****

```

#include <stdio.h>
int main()
{
    int i,N;
    float marks[900];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&marks[i]);
    }
    for(i=0;i<N;i++) {
        marks[i]=(marks[i]*100)/60;
    }
    return 0;
}

```

***** Question – 3.2 *****

Write a C program that takes a list of N unsorted integers and store it into an array. Then it searches for a number P (call it Key), and will return the index positions of P from the array of N unsorted integers, where P (the value of Key) will be entered by the user.

Input:

Enter the list of elements: 6

Enter the elements: 7 2 6 7 1 9

Key: 4

Output: Not found

Input:

Enter the list of elements: 6

Enter the elements: 7 2 6 7 1 9

Key: 7

Output: 0 3

***** Answer – 3.2 *****

```

#include <stdio.h>
int main()
{
    int i,N,P,Arr[1000];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&Arr[i]);
    }
    printf("Enter the key element in the array: ");
    scanf("%d",&P);
    for(i=0;i<N;i++) {
        if(Arr[i]==P) {
            printf("%d ",i);
        }
    }
}

```

```

    }
}
return 0;
}

```

***** Question – 3.3 *****

The name of a person consists of two parts – first name, and last name. Write a C program that will read two components of a name as two strings and will print it in short form as one single string.

For example, it will read:

First name: Sachin

Last name: Tendulkar

And will print:

Full name: S.Tendulkar

Do not use any string library function.

***** Answer – 3.3 *****

```

#include <stdio.h>

int main()
{
    char fname[30],lname[30],fullname[100];
    int i,j;

    printf("First name: ");
    scanf("%s",fname);
    printf("Last name: ");
    scanf("%s",lname);
    i=0;
    j=0;

    fullname[i]=fname[0];
    i++;
    fullname[i]='.';
    i++;
    while(lname[j]!='\0') {
        fullname[i]=lname[j];
        i++;
        j++;
    }
    fullname[i]='\0';

    printf("Full name: %s",fullname);
    return 0;
}

```

+++++ Topic-4 +++++

***** Question – 4.1 *****

Without using the support for pre-defined string library functions, a student wishes to write his/her own string comparison function

from scratch. Write a C function that will be called from the following main() function and will return 0 (if both the strings are same), 1 otherwise. The following code is provided. You need to write the function as indicated by comment.

```
#include <stdio.h>

/* Your compareStr function will be placed here. */
```

```
int main()
{
    char str1[100],str2[100];
    scanf("%s",str1);
    scanf("%s",str2);
    if(compareStr(str1,str2)==0) {
        printf("String Match!\n");
    } else {
        printf("String Mismatch!\n");
    }
    return 0;
}
```

***** Answer - 4.1 *****

```
#include <stdio.h>
```

```
int compareStr(char s1[],char s2[])
{
    int i,flag;
    i=0;
    flag=0;
    while((s1[i]!='\0') && (s2[i]!='\0')) {
        if(s1[i]==s2[i]) {
            i++;
        } else {
            flag=1;
            break;
        }
    }
    return flag;
}
```

```
int main()
{
    char str1[100],str2[100];
    scanf("%s",str1);
    scanf("%s",str2);
    if(compareStr(str1,str2)==0) {
        printf("String Match!\n");
    } else {
        printf("String Mismatch!\n");
    }
    return 0;
}
```

***** Question – 4.2 *****

Write a C function that will take a list of integers and the number of elements in the list as arguments and will return the sum of the square of those numbers.

Input:

Enter the list of integers: 5

Enter the integers: 4 7 2 8

Output:

Sum of square of integers: 133

The following code is provided. You need to write the function as indicated by comment.

```
#include <stdio.h>
```

```
/* Your sum2 function will be placed here. */
```

```
int main()
{
    int i,N,Arr[1000];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&Arr[i]);
    }
    printf("Sum of all the elements is : %d",sum2(Arr,N));
    return 0;
}
```

***** Answer – 4.2 *****

```
#include <stdio.h>
```

```
int sum(int arr[],int N)
{
    int i,sum=0;
    for(i=0;i<N;i++) {
        sum=sum+arr[i]*arr[i];
    }
    return sum;
}
```

```
int main()
{
    int i,N,Arr[1000];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&Arr[i]);
    }
    printf("Sum of all the elements is : %d",sum(Arr,N));
    return 0;
}
```

```
}
```

***** Question - 4.3 *****

Write a C function that will take a sorted list of integers and the number of elements in the list as arguments and will return the median of those numbers. If the number of integers is even, then the median is the average of the two middle elements (see sample input/output below).

Input:

Enter the number of integers: 7

Enter the integers: 2 4 6 8 10 13 15

Output: 8

Enter the number of integers: 6

Enter the integers: 2 4 6 8 10 13

Output: 7

The following code is provided. You need to write the function as indicated by comment.

```
#include <stdio.h>
```

```
/* Your median function will be placed here. */
```

```
int main()
{
    int i,N,Arr[1000];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements in sorted order: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&Arr[i]);
    }
    printf("Median is : %d",median(Arr,N));
    return 0;
}
```

***** Answer - 4.3 *****

```
#include <stdio.h>
```

```
int median(int arr[],int N)
{
    int mid,midVal;

    if(N%2==1) {
        mid=(N+1)/2;
        midVal=arr[mid];
    } else {
        mid=N/2;
        midVal=(arr[mid]+arr[mid+1])/2;
    }
    return midVal;
}
```

```

int main()
{
    int i,N,Arr[1000];
    printf("Enter the number of elements in the array: ");
    scanf("%d",&N);
    printf("Enter %d array elements in sorted order: ",N);
    for(i=0;i<N;i++) {
        scanf("%d",&Arr[i]);
    }
    printf("Median is : %d",median(Arr,N));
    return 0;
}

```

```

=====
=====

```

```

=====
=====
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-----

```

+++++++ Topic-1 ++++++

***** Question - 1.1 *****

Write a C program to multiply a given integer with 3.5 using bitwise operations. You are NOT allowed to use multiplication or division operators in your program. The program should take the integer as input and print the product as output.

***** Answer - 1.1 *****

```
#include <stdio.h>
```

```

int main()
{
    unsigned int data;
    printf("Enter the number to multiply:\t");
    scanf("%u", &data);
    data = (data<<1) + data + (data>>1);
    // equivalent to (data x 2) + data + (data / 2) = data x 3.5
    printf("product = %d\n", data);
    return 0;
}

```

***** Question - 1.2 *****

Write a C program to take the three internal angles of a triangle as input and then check whether it forms a valid triangle or not. A triangle is said to be valid if the sum of all the three angles is equal to 180 degrees.

Test case 1:

```

        Input: 45 90 45
        Output: Valid
Test case 2:
        Input: 120 10 55
        Output: Invalid
Test case 3:
        Input: 100 5 45
        Output: Invalid
Test case 4:
        Input: 100 85 -5
        Output: Invalid

```

***** Answer - 1.2 *****

```
#include<stdio.h>
```

```

int main()
{
    double angle1, double angle2, angle3;

    printf("\n Enter the internal angles of a triangle:");
    scanf("%lf %lf %lf", &angle1, &angle2, &angle3);

    if((angle1+ angle2+ angle3 == 180.00) && (angle1 >0) && (angle2
>0) && (angle3 >0))
        printf("\n The angles form a valid triangle");
    else
        printf("\n The angles do not form a valid triangle");

    return 0;
}

```

***** Question - 1.3 *****

Write a program to swap two nibbles of a given byte. One nibble has 4 bits, so a byte consists of 2 nibbles.
[Hint: Read the byte inputs with datatype char]

Example:

```

input: 200
output:140

```

Explanation:

```

Binary of 200: 1100 1000      (Two nibbles: 1100, 1000)
Binary of 140: 1000 1100      (Nibbles swapped)

```

***** Answer - 1.3 *****

```
#include<stdio.h>
```

```

int main()
{
    unsigned char number;
    unsigned char revNumber;
    printf("Enter an integer number :");
    scanf("%u",&number);
    revNumber= ( (number & 0x0F)<<4 | (number & 0xF0)>>4 );
    printf("\nEntered Number was : %u \nNumber after swapping

```

```
nibbles : %u", number, revNumber);
    return 0;
}
```

+++++++ Topic-2 ++++++

***** Question – 2.1 *****

Write a C program using suitable loops to find out whether a given number is an odd palindrome. A palindrome number is a number that remains the same when its digits are reversed. For example 121, 34543, 343, 131, 48984 are the palindrome numbers. Out of these 121, 34543, 343, and 131 are only odd. Your code should print whether the entered number is an odd palindrome or not.

***** Answer – 2.1 *****

```
#include <stdio.h>
```

```
int main()
{
    int n, reversed = 0, original;

    printf("Enter a number to check if it's a palindrome or not\n");
    scanf("%d", &n);

    original = n;

    while (original != 0)
    {
        reversed = reversed * 10;
        reversed = reversed + (original % 10);
        original = original / 10;
    }

    if (n == reversed && n%2==1)
    {
        printf("%d is an odd palindrome number.\n", n);
    }
    else
        printf("%d is not an odd palindrome number.\n", n);

    return 0;
}
```

***** Question – 2.2 *****

Write a C program using suitable loops that takes a decimal number as input and converts it to its binary equivalent without using arrays.

Test case 1:

Input: 5

Output: 101

Test case 2:

Input: 7
Output: 111

***** Answer – 2.2 *****

```
#include<stdio.h>
int main()
{
    int n, i, j, decimal_no, binary_no =0;

    printf("\n Enter a decimal number: ");
    scanf("%d", &n);

    decimal_no = n;
    i = 1;
    for(j = n ; j > 0 ; j = j / 2)
    {
        binary_no = binary_no + (n % 2) * i;
        i = i * 10;
        n = n / 2;
    }
    printf("\nThe binary equivalent of %d is
%d.",decimal_no,binary_no);
    return 0;
}
```

***** Question – 2.3 *****

Write a program to count the frequency of a digit in a given number.

Example:

Enter any number: 1667

Enter a digit whose frequency is to be calculated: 6

Output: Frequency of 6 in 1667 is 2

Another Example:

Enter any number: 1667

Enter a digit whose frequency is to be calculated: 3

Output: Frequency of 6 in 1667 is 0

***** Answer – 2.3 *****

```
#include <stdio.h>
int main()
{
    int num,n,digit,lastDigit,count;
    printf("Enter any number: ");
    scanf("%d", &num);
    printf("\nEnter a digit whose frequency is to be calculated:
");
    scanf("%d", &digit);
    n = num;
    count=0;
    while(n != 0)
    {
        lastDigit = n % 10;
        n /= 10;
```

```

        if(digit==lastDigit)
            count++;
    }
    printf("\nFrequency of %d in %d is %d\n", digit,num,count);

    return 0;
}

```

+++++++ Topic-3 ++++++

***** Question - 3.1 *****

Write a C program to print the following 2-dimensional triangular number sequence:

```

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 5 1

```

... ..

If we denote the rows by i and columns by j , then any element (except the boundary elements) in the triangle is given by: $p[i][j]=p[i-1][j-1]+p[i-1][j]$. The boundary elements are all 1, as shown in the above number sequence.

Write the program to print the triangle for 10 rows.

***** Answer - 3.1 *****

```
#include <stdio.h>
```

```

int main()
{
    int p[10][10];
    int row,col;
    for (row=0;row<10;row++)
        for (col=0;col<10;col++)
            p[row][col]=0;
    for(row=0;row<10;row++)
    {
        for(col=0;col<=row;col++)
        {
            if(row==col || col==0)
                p[row][col]=1;
            else
                p[row][col]=p[row-1][col-1]+p[row-1][col];
        }
    }
    for(row=0;row<10;row++)
    {
        for(col=0;col<=row;col++)
            printf("%d ",p[row][col]);
        printf("\n");
    }
}

```

```
    return 0;
}
```

***** Question – 3.2 *****

Write a C program to define an integer array of maximum length MAX_LENGTH=100. Ask the user to provide the number of elements to be entered and read in a variable 'n', and a predefined value (denoted as 'sum'). Take these sum, array length and the corresponding array as inputs and find the number of pairs in the array whose sum is equal to 'sum'.

Example:

Suppose, n=4, and the array elements are : { 1, 5, 7, -1}. Suppose, sum=6.

Pairs with sum 6 are (1,5), (7,-1). Hence the output of the program should be 2.

***** Answer – 3.2 *****

```
#include <stdio.h>

#define MAX_LENGTH 100

int main()
{
    int arr[MAX_LENGTH];
    int n = 0, sum = 0;
    printf("Enter the number of elements to be entered\n");
    scanf("%d",&n);

    printf("Enter the array elements\n");
    for(int i = 0; i < n; i++)
    {
        scanf("%d",&arr[i]);
    }
    printf("Enter the value of sum\n");
    scanf("%d",&sum);
    int count = 0;

    for (int i = 0; i < n; i++)
    {
        for (int j = i + 1; j < n; j++)
        {
            if (arr[i] + arr[j] == sum)
            {
                count++;
            }
        }
    }
    printf("Total number of pairs is: %d\n",count);
    return 0;
}
```

***** Question – 3.3 *****

Write a C program to define an integer array of maximum length MAX_LENGTH=100. Ask the user to provide the number of elements to be entered and read in a variable 'n'. Write the program to find the most occurring number in that array. If two numbers occur equal number of times, output any of them.

For example:

Example 1:

Input:

Suppose, n=5

and the array elements are, arr = [5, 4, 3, 5, 1]

Output: 5

Example 2:

Input:

Suppose, n=6

and the array elements are, arr = [10, 2, 4, 3, 2, 10]

Output: Anyone of 10 or 2 (Note this is not the print format, but just shows any of 2 or 10 can be a valid output)

Example 3:

Input:

Suppose, n=7

and the array elements are, arr = [2, 14, 3, 2, 14, 3, 1]

Output: 2 or 3 or 14

Example 4:

Input:

Suppose, n=5

and the array elements are, arr = [15, 15, 15, 15, 15]

Output: 15

***** Answer - 3.3 *****

```
#include<stdio.h>
```

```
#define MAX_LENGTH 100
```

```
int main() {
    int arr[MAX_LENGTH];
    int i, n, max_count;
    printf("Enter n: ");
    scanf("%d", &n);
    printf("Enter array elements: \n");
    for(i=0;i<n;i++) {
        scanf("%d", &arr[i]);
    }
    max_count = 0, curr_count = 0, max_el = -1;
    for(i=0;i<n;i++) {
        int v = arr[i];
        counted
        curr_count = 1;
        first occurrence
        for(int j=i+1;j<n;j++) {
            if(j<n && arr[j]==v) { //j<n condition to check for array
                index is within bounds
                curr_count += 1; //counting occurrences
            }
        }
        if(curr_count > max_count) {
            max_count = curr_count;
            max_el = v;
        }
    }
    printf("Most occurring element is: %d", max_el);
}
```

```

    }
}
if(curr_count > max_count){ //comparing count of current
element to maximum count obtained so far
    max_count = curr_count;
    max_el = v;
}
}
printf("The most occurring element is %d.\n", max_el);
return 0;
}

```

+++++++ Topic-4 ++++++

***** Question - 4.1 *****

Fill in the blanks marked as numbers like __ (1) __, __ (2) __, __ (3) __, __ (4) __ in the following C code segment such that upon execution the code the following output is printed.

```

      1
    1 1
  1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

```

```
#include <stdio.h>
```

```
int NUMBER_OF_ROWS = __ (1) __;
```

```
int factorial(int n)
{
    int fact;
    for(fact = 1; n > 1; n--)
    {
        fact *= n;
    }

```

```
    return fact;
}

```

```
int ncr(int n,int r)
{
    return _____ (2) _____;
}

```

```
int main()
{
    int i, j;

    for(i = 0; i <= NUMBER_OF_ROWS; i++)
    {
        for(j = 0; j <= _____ (3) _____; j++)

```

```

    {
        printf("    ");
    }

    for(j = 0; j <= i; j++)
    {
        printf("    %3d", _____(4)_____);
    }
    printf("\n");
}
return 0;
}

```

Only mention the blank portion of the code segment marking them as (1), (2), (3) and (4).

***** Answer - 4.1 *****

- (1) 5
- (2) factorial(n) / (factorial(n-r) * factorial(r))
- (3) (NUMBER_OF_ROWS - i)
- (4) ncr(i, j)

***** Question - 4.2 *****

Consider the following C Function isPrime() to check whether a number is a prime or not. Write a C program using isPrime() to check whether a given number (taken from the user as input) can be expressed as a sum of two unique prime numbers. Display all such combinations of prime numbers for the given input. For example, if the user input is 34, then the output should be all of the following: 34 = 3 + 31, 34 = 5 + 29, 34 = 11 + 23. (Note that, 34 = 17 + 17 is not a correct output since the prime numbers are not unique).

```

#include <math.h>
int isPrime(int n) {
    int i, flag = 1;
    for (i = 2; i <= sqrt(n); i++) {
        if (n % i == 0) {
            flag = 0;
            break;
        }
    }
    return flag;
}

```

***** Answer - 4.2 *****

```

#include <stdio.h>

int isPrime(int n);
int main() {
    int n, i, flag = 0;
    printf("Enter a positive integer: ");
    scanf("%d", &n);
    for (i = 2; i < n / 2; ++i) {
        if (isPrime(i) == 1) {

```

```

        if (isPrime(n - i) == 1) {
            printf("n = %d + %d\n", n, i, n - i);
            flag = 1;
        }
    }
    if (flag == 0)
        printf("n cannot be expressed as the sum of two prime
numbers.", n);
    return 0;
}

```

***** Question - 4.3 *****

A perfect number is an integer that is equal to the sum of its proper divisors (ie. divisors excluding the number itself). For example: 6 is a perfect number, which is sum of 1,2 and 3. In the following C program that prints all the perfect numbers in 1 to 1000, there are missing blanks numbered like __ (1) __, __ (2) __, __ (3) __. In the code, the function isPerfect(int) is to check if the passed integer is a perfect number. Only write as answer the blank parts by mentioning the missing details corresponding to the numbers (1), (2) and (3).

```
#include<stdio.h>
```

```

int isPerfect(int x) {
    int sum_of_divisors = 0;
    for(int i=1;_____(1)_____;i++) {
        if(x%i == 0) {
            sum_of_divisors = _____(2)_____;
        }
    }
    if(x == sum_of_divisors)
        return 1;
    else
        return 0;
}

```

```

int main() {
    int n = 1000;
    for(int i=1;i<n;i++) {
        if(_____(3)_____) {
            printf("n is a perfect number.\n", i);
        }
    }
    return 0;
}

```

***** Answer - 4.3 *****

- (1) i<x
- (2) sum_of_divisors + i;
- (3) isPerfect(i)==1

=====

=====

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+++++++ Topic-1 ++++++

***** Question - 1.1 *****

Write a program that takes three input integers x, y and z, where $x > 1$, $y > 1$ and z can be either 0 or 1. The program does not use any relational, logical and conditional operators and computes the value of some integer variable 'output' as x if z is 0 and as y otherwise. The program prints the value of 'output' and exits.

***** Answer - 1.1 *****

```
#include <stdio.h>
int main (){
    int x, y, z, output;
    printf("Enter 3 integers x, y, z (0 or 1):\n");
    scanf(" %d %d %d",&x,&y,&z);
    output = ((1 - z) * x) + (z * y);
    return 0;
}
```

***** Question - 1.2 *****

Write a program which takes 4 integer values (unsorted) in 4 variables and finds the maximum integer value using ternary operation only without the use of conditional (if, else, switch) statements. Also, do not use arrays in this program. For example, if 31, 9, 23, 50 are taken as input, the program should print 50 as output.

***** Answer - 1.2 *****

```
#include <stdio.h>
int main (){
    int a,b,c,d,max;
    printf("Enter 4 integer variables: \n");
    scanf("%d %d %d %d", &a,&b,&c,&d);
    max = a>b ? ( a>c ? ( a>d?a:d ) : ( c>d?c:d ) ) : ( b>c ? ( b>d?
b:d ) : ( c>d?c:d ) );
    printf("max: %d\n",max);
    return 0;
}
```

***** Question - 1.3 *****

Write a C program that can function like a basic calculator i.e. the

program takes as input two real numbers and an operator (+ for ADDITION, - for SUBTRACTION, * for MULTIPLICATION, / for DIVISION) separated by space and prints the output. The program handles only one of these operations in a single run. For example, if the input real numbers are 1,2, and the input operator is +, then the program outputs 3; If the input real numbers are 2,3, and the input operator is /, then the program outputs 0.666667.

***** Answer - 1.3 *****

```
#include <stdio.h>
int main (){
    float num1,num2;
    char operator;
    printf("Enter first number, operator and second number separated
by space:\n");
    scanf("%f %c %f ", &num1, &operator, &num2);
    switch(operator) {
        case '+':
            printf("Output: %f\n",num1+num2);
            break;
        case '-':
            printf("Output: %f\n",num1-num2);
            break;
        case '*':
            printf("Output: %f\n",num1*num2);
            break;
        case '/':
            if (num2!=0.0f)
                printf("Output: %f\n",num1/num2);
            else
                printf("Math error. Denominator can not be 0\n");
            break;
        default:
            printf("Operator not found");
    }
    return 0;
}
```

+++++ Topic-2 +++++

***** Question - 2.1 *****

Write a program, which scans from user an integer, obtains the minimum digit and maximum digit of n and prints the sum of these two digits to the console. For example, if n=51263, the result would be 6+1=7.

***** Answer - 2.1 *****

```
int main()
{
    int n, d;
    int p, q=0;
    scanf("%d",&n);
    p=n%10;
```

```

do
{
    d = n%10;
    n=n/10;
    p=p<=d?p:d;  q=q>d?q:d;
} while(n!=0);
printf("%d\n",p+q);
return 0;
}

```

***** Question – 2.2 *****

Write a program which

- i) scans a sequence of integers entered by the user in the console
- ii) stops scanning when a total of 5 even positive numbers have been scanned as input
- iii) prints the sum of these 5 even positive numbers and terminates.

For example, consider this input sequence -5 2 5 2 6 3 5 4 8. The program will not scan any more number from the console since it has seen the 5 even numbers 2,2,6,4,8. After the program scans the 5th even number 8, it continues execution and prints the value of the sum of these even numbers i.e. 2+2+6+4+8=22 and terminate.

***** Answer – 2.2 *****

```

int main()
{
    int sum=0;
    int n;
    int counter=0;
    while(1)
    {
        scanf("%d",&n);
        if(n>=0 && n%2==0)
        {
            sum=sum+n;
            counter=counter+1;
        }
        if(counter==5)
            break;
    }
    printf("%d\n",sum);
    return 0;
}

```

***** Question – 2.3 *****

Write a program that takes an integer n as input and prints only those pairs (i,j) for which i+j is even and i<=j<=n. Each pair is printed only once.

For example, if n=6, the program outputs

(1,1); (1,3); (1,5); (2,2); (2,4); (2,6); (3,3); (3,5); (4,4); (4,6); (5,5); (6,6);

Note: Marks will be deducted for inefficient programs.

***** Answer - 2.3 *****

```
int main()
{
    int n;
    int i,j,k,diff,flag;
    scanf("%d",&n);
    for(i=1;i<=n;i++)
    {
        for(j=i;j<=n;j++)
        {
            if((i+j)%2==0)
                printf("(%d,%d); ", i, j);
        }
    }
    return 0;
}
```

+++++ Topic-3 +++++

***** Question - 3.1 *****

Write a program which initializes an array X of size 100 with integers 1-100. The elements of the array are initialized as follows. Elements 0 to 24 of X contains values 76-100 sequentially. Elements 25 to 49 of X contains values 1-25 sequentially. Elements 50 to 74 of X contains 51-75 sequentially. Elements 75 to 99 of X contains 26-50 sequentially. The program then reorders the elements of the array X such that the constituent numbers are sorted from 1 to 100, i.e. $X[i] = i+1$.

Note: Marks will be deducted for inefficient programs.

***** Answer - 3.1 *****

```
int main()
{
    int temp, X[100];
    // initialization for the array X[ ]
    for(j=25;j<50;j++){
        temp=X[j]; X[j]=X[j+50]; X[j+50]=temp;
    }
    for(j=0;j<25;j++){
        temp=X[j]; X[j]=X[j+75]; X[j+75]=temp;
    }
    return 0;
}
```

***** Question - 3.2 *****

Write a program which takes as input a string from the user, and reverses the string without using another character array. Finally the reversed string is printed out by the program. The program uses a single character array rev[100]. You should not use any pre-defined function from the string library.

***** Answer - 3.2 *****

```
#include <stdio.h>
```

```
int main()
{
    char rev[100];
    char temp;
    int i=0,j=0;
    scanf("%s",rev);

    while(rev[j+1]!='\0')
        j++;
    while(i<j)
    {
        temp=rev[i];
        rev[i]=rev[j];
        rev[j]=temp;
        i++;
        j--;
    }
    printf("%s\n",rev);
    return 0;
}
```

***** Question - 3.3 *****

An anagram is a word formed by rearranging the letters of a different word. For example, "listen" and "silent"; "santa" and "satan"! Write a program which takes as input two strings in lower case English alphabet and checks whether they are anagrams. You should not use any pre-defined function from the string library.

***** Answer - 3.3 *****

```
#include <stdio.h>
```

```
int main (void) {
    char s1[100],s2[100];
    char temp;
    printf("Enter two strings in lower case separated by space: \n");
    scanf(" %s %s",s1,s2);

    int c=0;
    int first[26] = {0}, second[26] = {0};

    while (s1[c] != '\0') {
        first[s1[c]-'a']++;
        c++;
    }

    c = 0;
    while (s2[c] != '\0') {
        second[s2[c]-'a']++;
        c++;
    }
}
```

```

for (c = 0; c < 26; c++)
    if (first[c] != second[c])
    {
        printf("Strings %s and %s are not anagrams! \n", s1, s2);
        return 0;
    }

printf("Strings %s and %s are anagrams! \n",s1,s2);
return 0;
}

```

+++++ Topic-4 +++++

***** Question - 4.1 *****

Write a function swap(int A[], int size, int i) which takes as input an array A of size n and swaps the adjacent array elements i.e A[i] with A[i+1] (here, i is an index of the array A). Write a program that takes as input an even sized array from user, calls the swap function repeatedly in such a way that consecutive elements at positions 2*i and 2*i+1 of array A are interchanged. The program prints the modified array A and exits.
For example, if A={10,20,30,40,50,60}, the output should be A={20,10,40,30,60,50}

***** Answer - 4.1 *****

```

#include<stdio.h>
#define MAX 50
int swap(int arr[MAX],int n,int i);

int main(){
    int i,n,arr[MAX];
    scanf("%d",&n);

    for(i=0;i < n;i++)
    {
        printf("Enter element %d:",i+1);
        scanf("%d",&arr[i]);
    }
    for(i=0;i <= (n/2)-1;i+=1)
    {
        swap(arr, n, i);
    }
    printf("\nArray elements after swapping adjacent elements:\n");
    for(i=0;i < n;i++)
    {
        printf("%d\n",arr[i]);
    }
    return 0;
}

int swap(int arr[],int size,int i)
{
    int temp;

```

```

        if(i<=size){
            temp = arr[2*i];
            arr[2*i] = arr[2*i+1];
            arr[2*i+1]= temp;
        }
        return 0;
    }
}

```

***** Question - 4.2 *****

The value of Exponential Function e^x can be computed using the following Taylor series expansion: $e^x = 1 + x/1! + x^2/2! + x^3/3! + \dots$

Write a function for computing factorials. Use it in your main program to compute the value of e^x for a user provided value of x . You should make suitable choice of data types and add the terms in the series as long as a new term ($x^i/i!$) is not less than ($0.01 \times \text{CurrentSum}$). Do NOT make use of math library functions.

***** Answer - 4.2 *****

```

#include <stdio.h>

int main(void) {
    int i=0, x;
    double mul =1.000;
    double exp =1.000;
    scanf("%d",&x);
    while(1){
        mul=mul*x/fact(i);
        exp=exp+mul;
        i++;
        if(mul<(0.01*exp)){
            break;
        }
    }
    printf("%.3f",exp);
    return 0;
}

int fact(int n){
    int res=1;
    for(int i=0;i<n;i++){
        res*=i+1;
    }
    if(n==0){
        res=1;
    }
    return res;
}

```

***** Question - 4.3 *****

Write a function `int isFact(int a, int c, int b, int fact[])` that figures out the factors/divisors of integer b which are greater than or equal to a , and less than or equal to c . The function populates the array `fact[]` with these elements. The function returns the number of such factors. Write a program which takes as input two

integers b1 and b2 and uses the function 'isFact' to print the common factors of b1 and b2 between 1 and 100.
Example: With input 30, 60, your program should print as output "1, 2, 3, 5, 6, 10, 15, 30" as these are the common factors of 30, 60 between 1 and 100.

***** Answer - 4.3 *****

```
#include <stdio.h>
```

```
int main(void) {
    int i=0, j=0, a=1, c=100, count1, count2;
    int B1, B2;
    int arr1[100];
    int arr2[100];
    scanf("%d %d",&B1,&B2);
    count1=isFact(a, c, B1, arr1);
    count2=isFact(a, c, B2, arr2);
    while(i<count1&& j<count2){
        if(arr1[i]<arr2[j]){
            i++;
        }else if(arr1[i]>arr2[j]){
            j++;
        }else{
            printf("%d\t",arr1[i++]);
            j++;
        }
    }
    return 0;
}

int isFact(int a,int c, int B, int fact[]){
    int i,j=0,res;
    for (i=a;i<=c;i++){
        res=B%i;
        if (!res){
            fact[j]=i;
            j++;
        }else{
            continue;
        }
    }
    return j;
}
```

```
=====
=====
```