Conditional Branching and Loops-IV

Iteration and Loop Example

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Outline

Objectives

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- Study on conditional branching, iteration and loop with examples
- Study on pattern display
- Study on series formation

Introduction[1],[2],[3], [4]

- All iteration problems are solved by any kind of loop
- Iterations are controlled by break and continue statement
- Iteration problems could be solved by recursive function also

Iteration and Loop Examples

Example 1

Write a program to calculate simple interest for twice.

$$SimpleInterest = (p * n * r)/100$$

Simple Interest Calculation

```
1  /*Calculation of simple interest for 2 times*/
2  #include<stdio.h>
3  int main()
4  {
5    int p,n,count;
6    float r, si;
7    count = 1;
8    while(count<=2)
9    {
10       printf("Enter principle amount, number of years and
         rate of interest: \t");
11       scanf("%d%d%f", &p, &n, &r);
12       si = (p*n*r)/100;
13       printf("%d th Simple interest: %6.2f", count, si);
14       printf("\n");
15       count++;
16   }
17   return 0;
18 }
```

Output

```
Enter principle amount, number of years
and rate of interest: 1000 2 3
1 th Simple interest: 60.00

Enter principle amount, number of years
and rate of interest: 2300 2 3
2 th Simple interest: 138.00
```

Iteration and Loop Examples

Example 2

Write a program to canculate factorial of a given number

$$factorial = f(n) * f(n-1) * \cdots * f(0)$$

Factorial Calculation

```
1  /*Find factorial of a given number*/
2  #include<stdio.h>
3  int main()
4  {
5    int num;
6    long int factorial;
7    factorial = 1;
8    printf("Enter a number:\t");
9    scanf("%d", &num);
10   do
11   {
12       factorial = factorial*num--;
13   }
14   while(num>1);
15   printf("Factorial value:\t%ld", factorial);
16   return 0;
17 }
```

Output

```
Enter a number: 5
Factorial value: 120
```

Iteration and Loop Examples

Example 3

Write a program to calculate x power y.

$$p = x^y$$

Power of x raised to y

```
1  /*Calculate power of x raised to y*/
2  #include<stdio.h>
3  int main()
4  {
5     int x,y, count=1;
6     long int p=1;
7     printf("Enter value of x and y:\t");
8     scanf("%d%d", &x, &y);
9     if(y==0)
10    printf("Power of %d raised to %d is %ld", x, y, p);
11    else
12    {
13       while(count<=y)
14       {
15            p = p*x;
16            count++;
17        }
18        printf("Power of %d raised to %d is %ld", x, y, p);
19    }
20    return 0;
21 }
```

Output

```
Enter value of x and y: 2 0
Power of 2 raised to 0 is 1
```

Iteration and Loop Examples

Example 4

Write a program to print Fibonacci Series

$$f(n) = f(n-1) + f(n-2)$$

Series Example:0 1 1 2 3 5 8 13 21 34

Print Fibonacci Series

```
1  /*Print Fibonacci Series: first=0, second=1*/
2  #include<stdio.h>
3  int main()
4  {
5    int a=0, b=1, c;
6    int n, count=1;
7    printf("How many terms are required:\t");
8    scanf("%d", &n);
9
10          printf("%d\t%d\t", a, b);
11
12   do
13   {
14     c = a + b;
15     printf("%d\t", c);
16     a = b;
17     b=c;
18     count++;
19   }
20   while((n-2)>=count);
21   return 0;
22 }
```

Output

How many terms are required: 10
0 1 1 2 3 5 8 13 21 34

Iteration and Loop Examples

Example 5

Write a program to display a mathematical table

Example: $mxn = mn$

Mathematical Table

```
1  /*Print Mathematicable Table*/
2  #include<stdio.h>
3  #include<stdlib.h>
4  int main()
5  {
6    int m, n, i;
7    char choice;
8  //Indicate label for control transfer
9      st:
10         system("clear");
11       printf("Enter the value of (m x n) :\t");
12       scanf("%d%d", &m, &n);
13       for(i=1; i<=m; i++)
14       {
15         printf("%d x %d = %d\n", n, i, n*i);
16       }
17       printf("Do you want to conrinue (Y/N):\t");
18       scanf(" %c", &choice);
19       //choice = getchar();
20       if (choice=='Y' || choice=='y')
21           goto st;
22       else
23           exit(0);
24   return 0;
25 }
```

Output

```
Enter the value of (m x n) : 10 3
3 x 1 = 3
3 x 2 = 6
3 x 3 = 9
3 x 4 = 12
3 x 5 = 15
3 x 6 = 18
3 x 7 = 21
3 x 8 = 24
3 x 9 = 27
3 x 10 = 30
Do you want to conrinue (Y/N): y
```

Iteration and Loop Examples

Example 6

Write a program to convert binary number into decimal number

$$b_4 b_3 b_2 b_1 b_0 = (b_4 * 2^4) + (b_3 * 2^3) + (b_2 * 2^2) + (b_1 * 2^1) + (b_0 * 2^0)$$

Binary to Deccimal Conversion

```c
/*Binary number into decimal number conversion*/
#include <stdio.h>
int main()
{
   int  num, binary_val, decimal_val = 0, base = 1, rem;

   printf("Enter a binary number(1s and 0s) \n");
   scanf("%d", &num); /* maximum five digits */
   binary_val = num;
   while (num > 0)
   {
        rem = num % 10;
        decimal_val = decimal_val + rem * base;
        num = num / 10 ;
        base = base * 2;
   }
   printf("The Binary number is = %d \n", binary_val);
   printf("Its decimal equivalent is = %d \n", decimal_val);
   return 0;
}
```

Output

```
Enter a binary number(1s and 0s)
1101110011
The Binary number is = 1101110011
Its decimal equivalent is = 883
```

Iteration and Loop Examples

Example 7

Write a C code to find Sum of Even and Odd Numbers from 1 to N.

$$S_{odd} = 1 + 3 + 5 + \cdots + (n-1)$$

$$S_{even} = 2 + 4 + 6 + \cdots + n$$

Sum of even and odd numbers from 1 to 100

```c
/*Find Sum of Even and Odd Numbers from 1 to N */
#include<stdio.h>
int main()
{
   int i, num, EvenS = 0, OddS = 0;
   printf("Enter the Maximum Limit Value : ");
   scanf("%d", &num);

   for(i = 1; i <= num; i++)
   {
     if ( i%2 == 0 )
     {
         EvenS = EvenS + i;
     }
     else
     {
       OddS = OddS + i;
   }
   }
   printf("\nSum of Even Numbers: %d", EvenS);
   printf("\nSum of Odd Numbers: %d", OddS);
   return 0;
}
```

Output

```
Enter the Maximum Limit Value : 100

Sum of Even Numbers: 2550
Sum of Odd Numbers: 2500
```

Iteration and Loop Examples

Example 8

Write a program to check a given number is Armstrong or not.

$$abcd = a^n + b^n + c^n + d^n$$

For number of 3 digits, sum of power three of each digit is equal to number itself is a Armstrong number as $153 = 1 * 1 * 1 + 5 * 5 * 5 + 3 * 3 * 3$

Check Armstrong number

```c
#include <stdio.h> /*Amstrong number*/
int main() {
    int num, originalNum, remainder, result = 0;
    printf("Enter a three-digit integer: ");
    scanf("%d", &num);
    originalNum = num;

    while (originalNum != 0) {
        // remainder contains the last digit
        remainder = originalNum % 10;

        result += remainder * remainder * remainder;

        // removing last digit from the orignal number
        originalNum /= 10;
    }
    if (result == num)
        printf("%d is an Armstrong number.", num);
    else
        printf("%d is not an Armstrong number.", num);
    return 0;
}
```

Output

```
Enter a three-digit integer: 153
153 is an Armstrong number.
```

Iteration and Loop Examples

Example 9

Write a program to check a given number is perfect number or not.

When a number is equal to sum of all its divisible number, called as perfect number.
Example: For a number 6, $1 + 2 + 3 = 6$; hence 6 is a perfect number.

Checking Perfect number

```c
/*Perfect number*/
#include <stdio.h>
int main()
{
int a, b, num;
printf("Enter a number : ");
scanf("%d",&num);
a = 1;
b = 0;
while(num > a)
{
if(num % a == 0)
b = b + a;
a++;
}
if(b == num)
printf("\n%d is a perfect number", a);
else
printf("\n%d is not a perfect number", a);
return 0;
}
```

Output

```
Enter a number : 28

28 is a perfect number
```

Iteration and Loop Examples

Example 10

Write a program to find LCM of two numbers.

Least Common Multiples(LCM) is the smallest common multiple.

Find LCM of two numbers

```c
/*Least Common Multiples(LCM) of two number*/
#include <stdio.h>
int main()
{
   int num1, num2, max;
   printf("Enter two positive integers: ");
   scanf("%d%d", &num1, &num2);
   max = (num1 > num2) ? num1 : num2;
   for(;;)
   {
      if(max % num1 == 0 && max % num2 == 0)
      {
         printf("LCM of %d and %d is %d ", num1, num2, max);
         break;
      }
      max++;
   }
   return 0;
}
```

Output

```
Enter two positive integers: 12 24
LCM of 12 and 24 is 24
```

Iteration and Loop Examples

Example 11

Write a program to print pyramid pattern with * symbols.

Display Pyramid Pattern

```
1  /*Draw full pyramid pattern of */
2  #include <stdio.h>
3  int main()
4  {
5      int i, space, rows, k = 0;
6      printf("Enter the number of rows: ");
7      scanf("%d", &rows);
8      for (i = 1; i <= rows; ++i, k = 0)
9      {
10         for (space = 1; space <= rows - i; ++space)
11         {
12             printf("  ");
13         }
14
15         while (k != 2 * i - 1)
16         {
17             printf("* ");
18             ++k;
19         }
20         printf("\n");
21     }
22     return 0;
23 }
```

Output

```
Enter the number of rows: 5
        *
      * * *
    * * * * *
  * * * * * * *
* * * * * * * * *
```

Iteration and Loop Examples

Example 12

Write a program to print the given pattern.

```c
/*Draw pattern*/
#include <stdio.h>
int main()
{   int i, space, rows, k = 0, count = 0, count1 = 0;
    printf("Enter the number of rows: ");
    scanf("%d", &rows);
    for (i = 1; i <= rows; ++i) {
        for (space = 1; space <= rows - i; ++space) {
            printf("  ");
            ++count;
        }
        while (k != 2 * i - 1) {
            if (count <= rows - 1) {
                printf("%d ", i + k);
                ++count;
            } else {
                ++count1;
                printf("%d ", (i + k - 2 * count1));
            }
            ++k;
        }
        count1 = count = k = 0;
        printf("\n");
    }
    return 0;
}
```

Output

```
Enter the number of rows: 5
        1
      2 3 2
    3 4 5 4 3
  4 5 6 7 6 5 4
5 6 7 8 9 8 7 6 5
```

Iteration and Loop Examples

Example 13

Write a program to display Pascal's triangle.

Display Pascal's Pattern

```c
/*Pascal's Triangle*/

#include <stdio.h>
int main() {
    int rows, coef = 1, space, i, j;
    printf("Enter the number of rows: ");
    scanf("%d", &rows);
    for (i = 0; i < rows; i++) {
        for (space = 1; space <= rows - i; space++)
            printf("  ");
        for (j = 0; j <= i; j++) {
            if (j == 0 || i == 0)
                coef = 1;
            else
                coef = coef * (i - j + 1) / j;
            printf("%4d", coef);
        }
        printf("\n");
    }
    return 0;
}
```

Output

```
Enter the number of rows: 5
        1
      1   1
    1   2   1
  1   3   3   1
1   4   6   4   1
```

Iteration and Loop Examples

Example 14

Write a program to print Flyod's triangle.

Display Flyod's Triangle

```
1  /*Flyod's Triangle*/
2  #include <stdio.h>
3  int main()
4  {
5      int rows, i, j, number = 1;
6      printf("Enter the number of rows: ");
7      scanf("%d", &rows);
8      for (i = 1; i <= rows; i++)
9      {
10         for (j = 1; j <= i; ++j)
11         {
12             printf("%d ", number);
13             ++number;
14         }
15         printf("\n");
16     }
17     return 0;
18 }
```

Output

```
Enter the number of rows: 5
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
```

Iteration and Loop Examples

Example 15

Write a program to print the matrix.

Matrix Pattern

```
1  /*Matrix pattern*/
2  #include <stdio.h>
3  int main()
4  { int n, p = 1, a[100][100], j, m, k, r;
5    printf("Enter number of rows:\t");
6    scanf("%d", &r);
7    for (j = 1; j <= r; j++) {
8      m = 0;
9      n = j;
10     for (k = 1; k <= j; k++)
11       a[m++][--n] = p++;
12   }
13   for (j = 1; j <= r-1; j++) {
14     m = j;
15     n = r-1;
16     for (k = 1; k<= r-j; k++)
17       a[m++][n--] = p++;
18   }
19   for (j = 0; j <= r-1; j++) {
20     for (k = 0; k <= r-1; k++)
21       printf("%d ", a[j][k]);
22     printf("\n");
23   }
24   return 0;
25 }
```

Output

```
Enter number of rows: 5
1   2   4   7   11
3   5   8   12   16
6   9   13   17   20
10   14   18   21   23
15   19   22   24   25
```

Iteration and Loop Examples

Example 16

Write a program to find the sum of series.

$$s = 1 + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}$$

Sum of Series

```c
// C program to find sum of series
#include <stdio.h>

// Function to return sum of 1/1 + 1/2 + 1/3 + ..+ 1/n

int main()
{
    int n = 5;
    double i, s = 0.0;
    for (i = 1; i <= n; i++)
        s = s + 1/i;
    printf("Sum is %f", s);
    return 0;
}
```

Output

Sum is 2.283333

Iteration and Loop Examples

Example 17

Write a program to find the sum of series.

$$S = \frac{1^1}{1!} + \frac{2^2}{2!} + \frac{3^3}{3!} + \frac{4^4}{4!} + \frac{5^5}{5!} + \cdots + \frac{n^n}{n!}$$

Sum of Series

```
1  /* Sum of series*/
2  #include<stdio.h>
3  #include<math.h>
4  int main()
5  {
6      long i,n;
7      double sum=0;
8      long j, f;
9      n=5;
10     for(i=1;i<=n;i++)
11     {
12         f=1;
13         for(j=1;j<=n;j++)
14         {
15             f=f*j;
16         }
17         sum=sum+pow(i,i)/f;
18     }
19     printf("Sum: %lf",sum);
20     return 0;
21 }
```

Output

```
Sum: 28.441667
```

Iteration and Loop Examples

Example 18

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Write a program to find the sum of series.

$$S = \frac{1!}{1} + \frac{2!}{2} + \frac{3!}{3} + \frac{4!}{4} + \frac{5!}{5} + \cdots + \frac{n!}{n}$$

Sum of Series

```
1  /*Find series sum*/
2  #include<stdio.h>
3  int main()
4  {
5      long i, n, f;
6      double sum=0;
7      n=5;
8      for(i=1;i<=n;i++)
9      {
10         f=1;
11         for(int j=1;j<=n;j++)
12             f=f*j;
13         sum=sum+(f/i);
14     }
15     printf("Sum: %lf",sum);
16     return 0;
17 }
```

Output

```
Sum: 274.000000
```

Iteration and Loop Examples

Example 19

Write a program toi find the sum of series.

$$s = (1) + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4) + \ldots + (1 + 2 + 3 + 4 + \ldots + n)$$

Sum of Series

```c
/* Find sum of series*/
#include<stdio.h>
int main()
{
    int i,j,n,sum=0;
    n=10;
    for(i=1;i<=n;i++)
    {
        for(j=1;j<=i;j++)
        {
            sum+=j;
        }
    }
    printf("Sum: %d",sum);
    return 0;
}
```

Output

```
Sum: 220
```

Iteration and Loop Examples

Example 20

Write a program to print the series.

Series: 1 2 3 6 9 18 27 54 81 162

Display Series

```
1  /* Print series
2  1 2 3 6 9 18 27 54...*/
3  #include<stdio.h>
4  int main()
5  {
6      int a=1,b=2,i,n=10;
7      printf("%d %d ",a, b);
8      for(i=3;i<=n;i++)
9      {
10         if(i%2==1)
11         {
12             a=a*3;
13             printf("%d ",a);
14         }
15         else
16         {
17             b=b*3;
18             printf("%d ",b);
19         }
20     }
21     return 0;
22 }
```

Output

```
1 2 3 6 9 18 27 54 81 162
```

Exercise

Exercise

- Write a program which accepts a number and prints the sum of digits of this number. Example, n=123, then output=6.
- Write a program to convert decimal to binary of a given number.
- Write a program to find out the Greatest Common Divisor(GCD) of two numbers.
- Write a program to print a half pyramid of alphabet characters.
- Write a program to display a inverted pyramid as follow

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

- Write a program for following pattern

```
      *
     *A*
    *A*A*
   *A*A*A*
```

- Write a program for sum of the series
  Series: 1/2 - 2/3 + 3/4 - 4/5 + 5/6 - ..... n
- Write a program for the following series
  Series: 1! + 2! + 3! + 4! + 5! + ... + n!

References I


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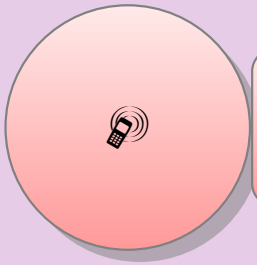

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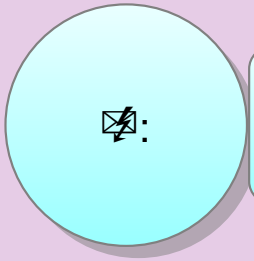

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Thank You...