Chapter 5

Loop Programing and Decision Making

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Objective

- Understand the Repetition(Loop) process
- Write programs which has repetition process statement.

Main content

- while
- do-while
- for

Why do we need Loop statement

- Recurrence(Repeating)situations.

  ex Program show name 20 time

- Recurrence situation which change value or condition

  ex Show number 0,1,2,...,10

  Show summation of 1,3,5,7,...,99

  Show name continuous since X>30

Program to show the numbers 0-10 (without Loop statement)

Write the Flowchart and Program to show number 0-10 on the display.

- **Output Analysis**

  - Show number 0, 1, 2,..., 10

- **Input Analysis**

  - No

Program to show the numbers 0-10 (without Loop statement)

- **Process Analysis**

  - Program show number 0, 1, 2,..., 10

- **Variable Define**

  - Not use or increase count

Program to show the numbers 0-10 (without Loop statement)

```
#include<stdio.h>
#include<conio.h>
int main()
{
    printf (“0\t”);
   printf (“1\t”);
   printf (“2\t”);
     ...
    printf (“10\t”);
    return 0;
}
```

```
#include<stdio.h>
#include<conio.h>
int main()
{
   int count = 0;
   printf (“%d\t”, count++);
   printf (“%d\t”, count++);
     ...
   printf (“%d\t”, count++);
   return 0;
}
```

Program to show the numbers 0-10

(with Loop statement)

```
#include<stdio.h>
#include<conio.h>
int main()
{
   int count = 0;
   while (count <= 10)
   {
         printf (“%d\t”, count++);
   }
   return 0;
}
```

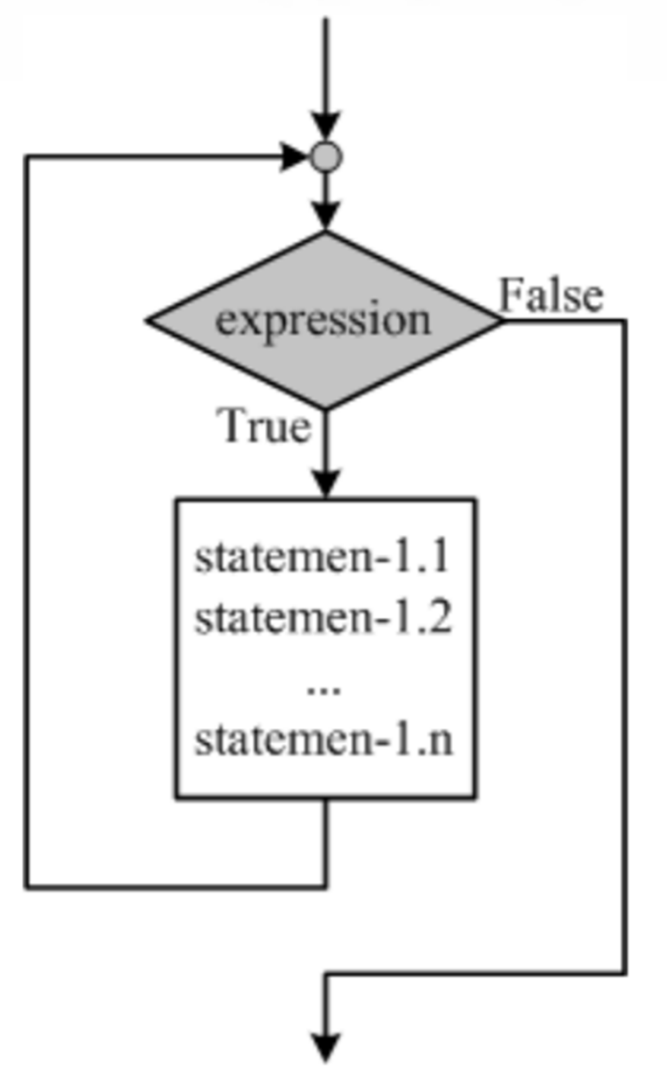
Loop Statement in C Language

- while
- do-while
- for

while

```
while (expression)
    statement-1;
```

```
while (expression)
{
    statement-1.1;
    statement-1.2;
    ...
    statement-1.n;
}
```



Example : Program to show the numbers 0-10 (while)

Write the Flowchart and Program to show number 0-10 on the display by use while statement.

- **Output Analysis**

  - Show number 0, 1, 2,..., 10

- **Input Analysis**

  - No

Example : Program to show the numbers 0-10 (while)

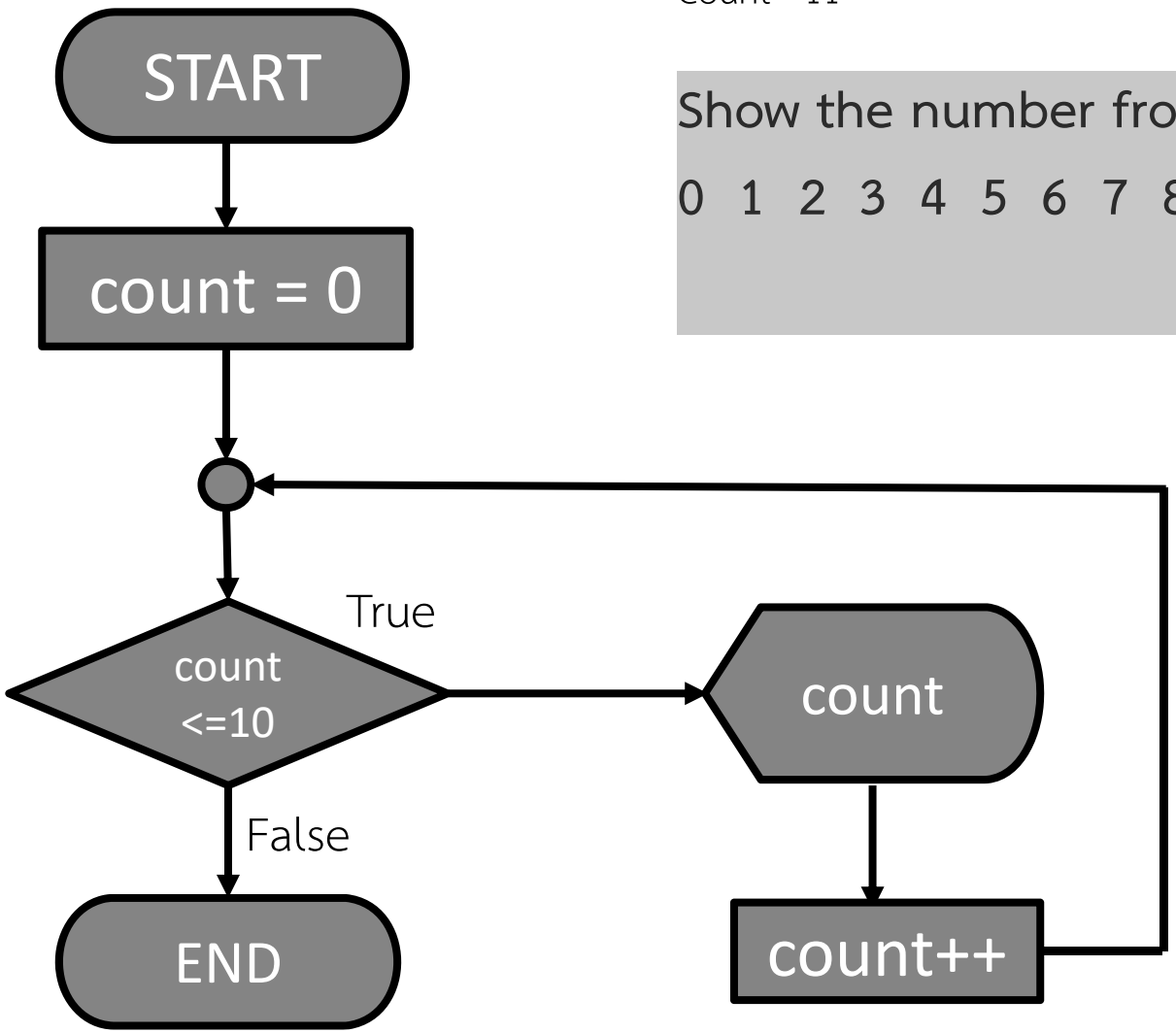
- **Process Analysis**

  - Program show number 0, 1, 2,..., 10

- **Variable Define**

  - count integer for count time

Example : Program to show the numbers 0-10 (while)



Count =11

Show the number from zero to ten

0 1 2 3 4 5 6 7 8 9 10

Example : Program to show the numbers 0-10 (while)

```
#include<stdio.h>
int main()
{
    int count = 0;
    printf (“Show number from zero to ten\n\n”);
    while (count <= 10)
    {
        printf (“%d\t”, count);
        count++;
    }
    return 0;
}
```

```
Show number from zero to ten

0       1       2       3       4       5       6       7       8       9       10
```

Example : Program to show the summation of integer numbers 1 to a define value (while)

Write a Flowchart and a Program to add integer numbers from 1 to a user define value by the use of while statement.

- **Output Analysis**

  - Summation of integers from 1 to a defined value from user.

- **Input Analysis**

  - Input value from user

Example : Program to show the summation of integer numbers 1 to a define value (while)

- **Process Analysis**

  - Program to ask user that what is the number you would like to add.

  - Use while statement to sum the values.

  - Show the result.

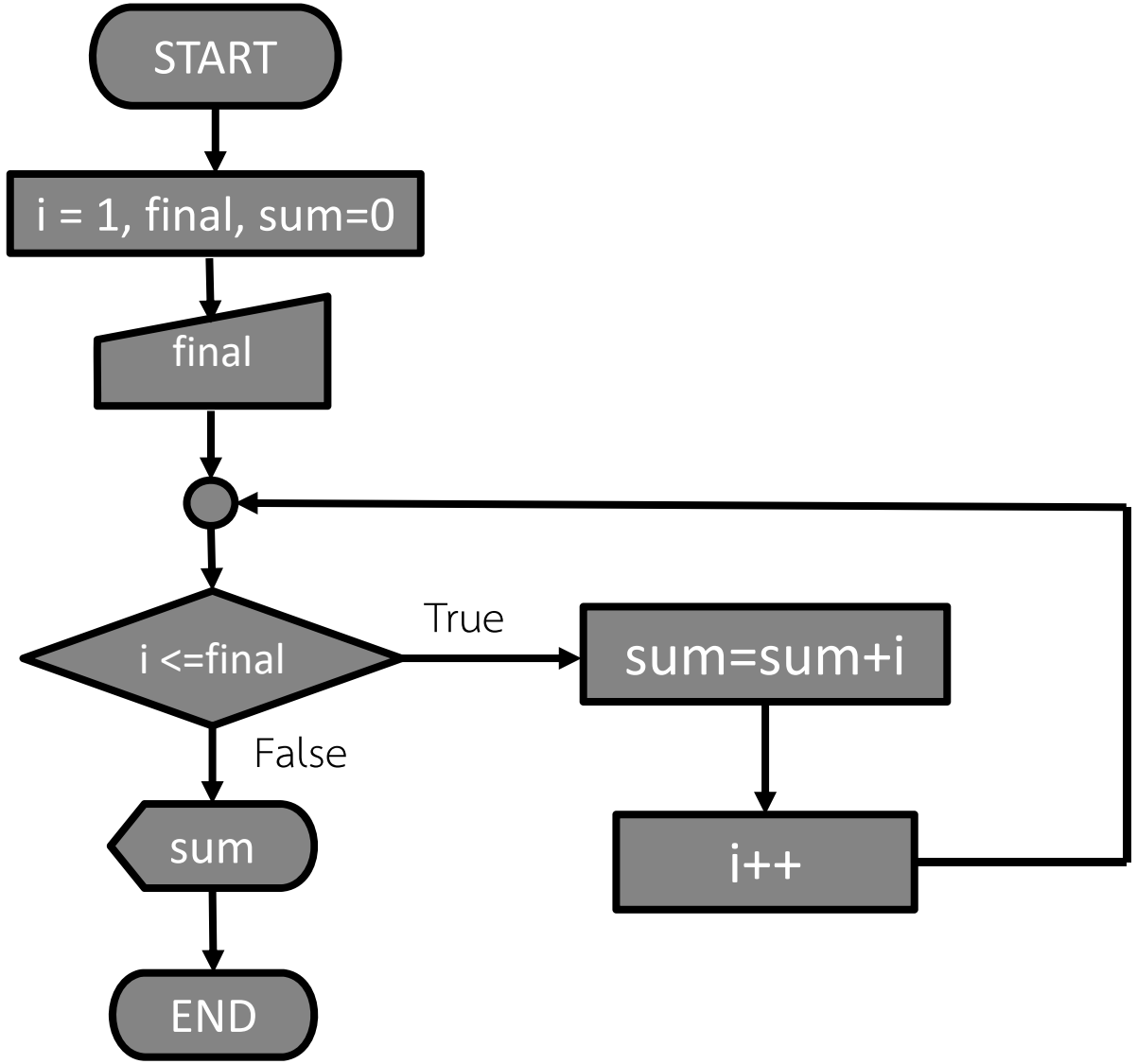
- **Variable Define**

  sum=0 Summation which initial value =0

  i=1 Added value which plus with sum at each loop initial =1 and increase 1 at each loop

  final Get value from user and define last value of i

Example : Program to show the summation of integer numbers 1 to a define value (while)



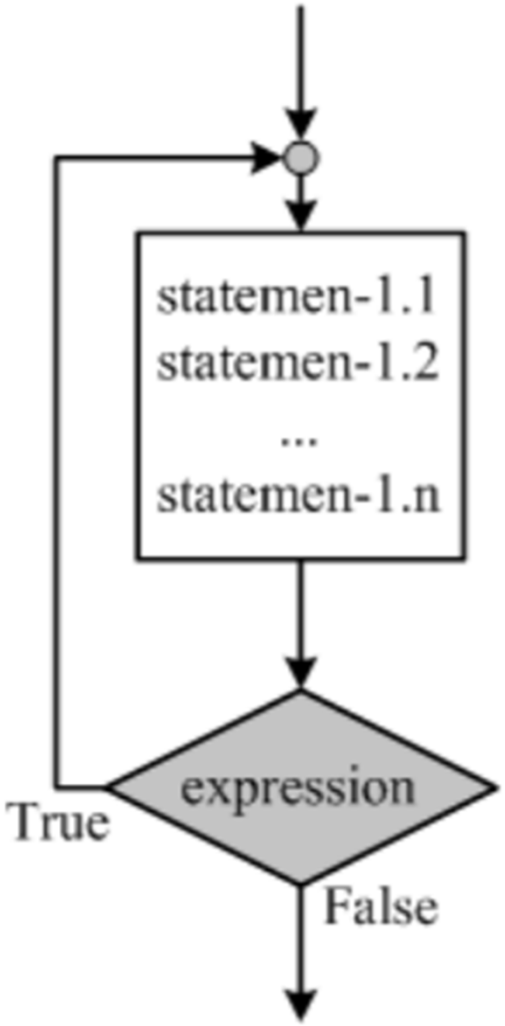
Example : Program to show the summation of integer numbers 1 to a define value (while)

```
int main()
{
    int i = 1, final, sum = 0;
    printf (“Enter final number: ”);
    scanf (“%d”, &final);
    while (i <= final)
    {
        sum = sum + i;
        i++;
    }
    printf (“Sum = %d”, sum);
    return 0;
}
```

do-while

```
do
statement-1.1;
while (expression);
```

```
do
{
    statement-1.1;
    statement-1.2;
    ...
    statement-1.n;
}
while (expression)
```



Example : Program to display the summation of numbers 1 to 100 (do-while)

Write a Flowchart and a Program to sum integer number from 1 to 100 by use do-while.

- **Output Analysis**

  - Summation of integers from 1 to 100.

- **Input Analysis**

  - No

Example : Program to display the summation of numbers 1 to 100 (do-while)

- **Process Analysis**

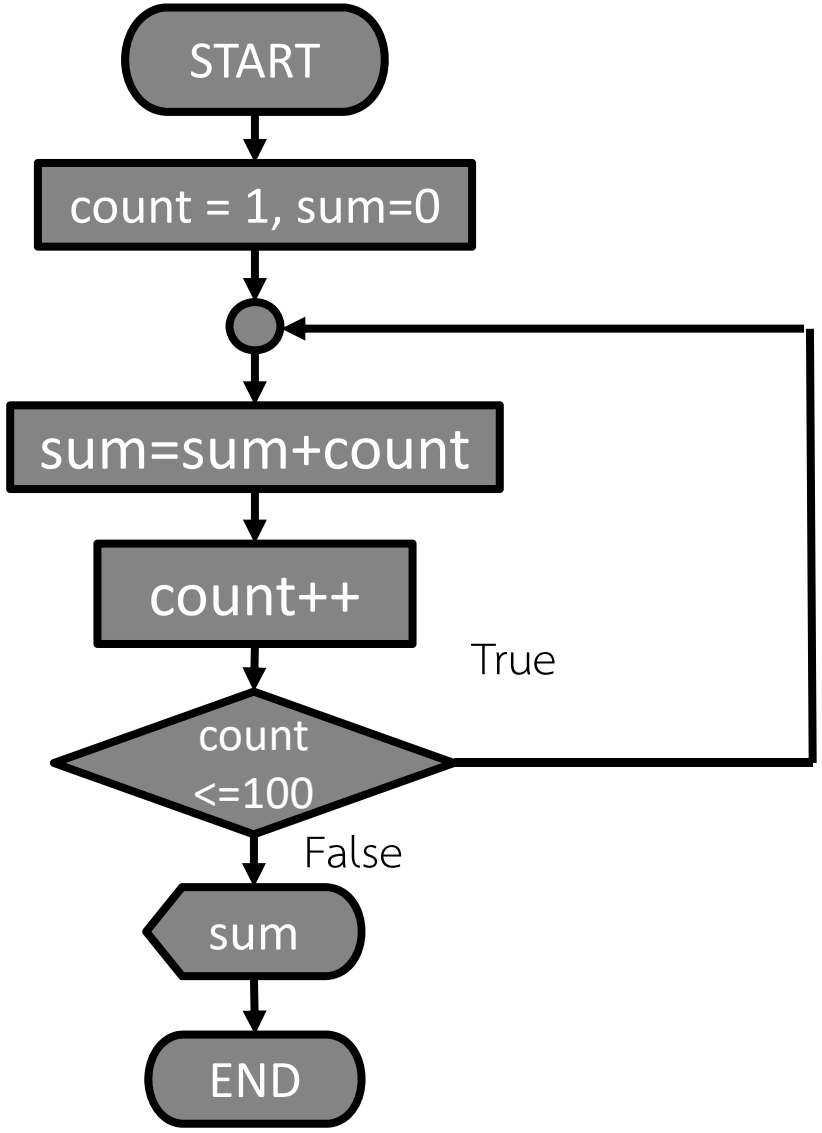
- Program summation and keep the value into a variable and increase to 100.

- **Variable Define**

count integer value to count the numbers

sum integer value to keep the summation

Example : Program to display the summation of numbers 1 to 100 (do-while)



Example : Program to display the summation of numbers 1 to 100

(do-while)

```
int main()
{
    int count = 1, sum = 0;
    do
    {
        sum = sum + count;
        count++;
    }
    while (count<=100);
    printf (“Summation of 1 to 100 = %d”, sum);
    return 0;
}
```

for

```
for (initial; expression; change)
{
    statement-1.1;
    statement-1.2;
    ...
    statement-1.n;
}
```

initial is initial value of variable

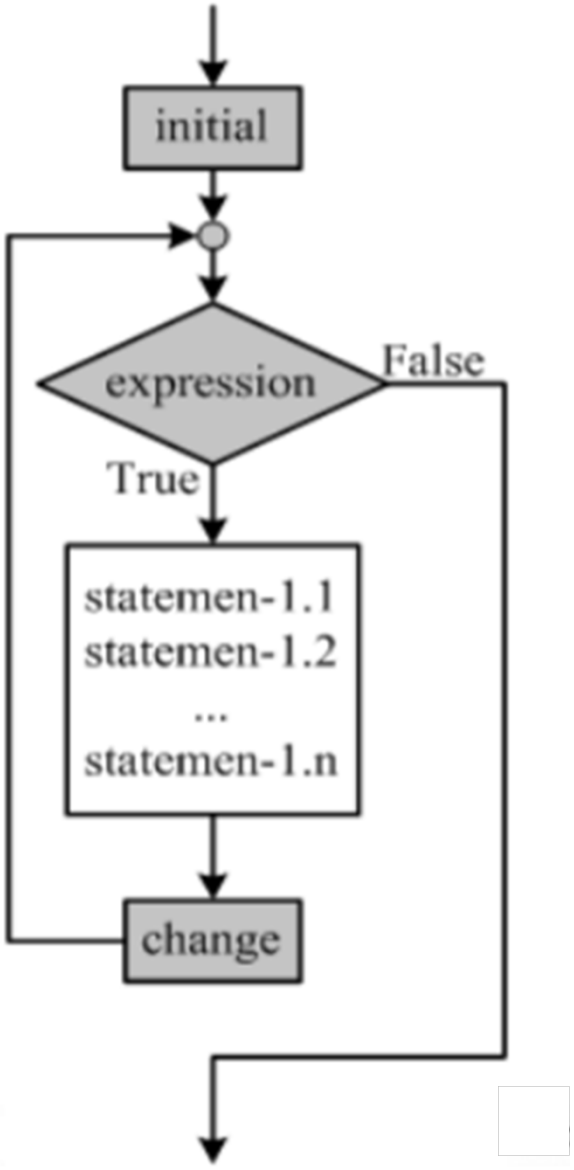
condition is preferred condition

change is changeable variable

Statement-1,2,...,n is statement

Is the action if the statement is true

for


initial
expression
False
True
statemen-1.1
statemen-1.2
...
statemen-1.n
change

Example : Program to display the summation of numbers 1 to 100 (for)

- **Process Analysis**

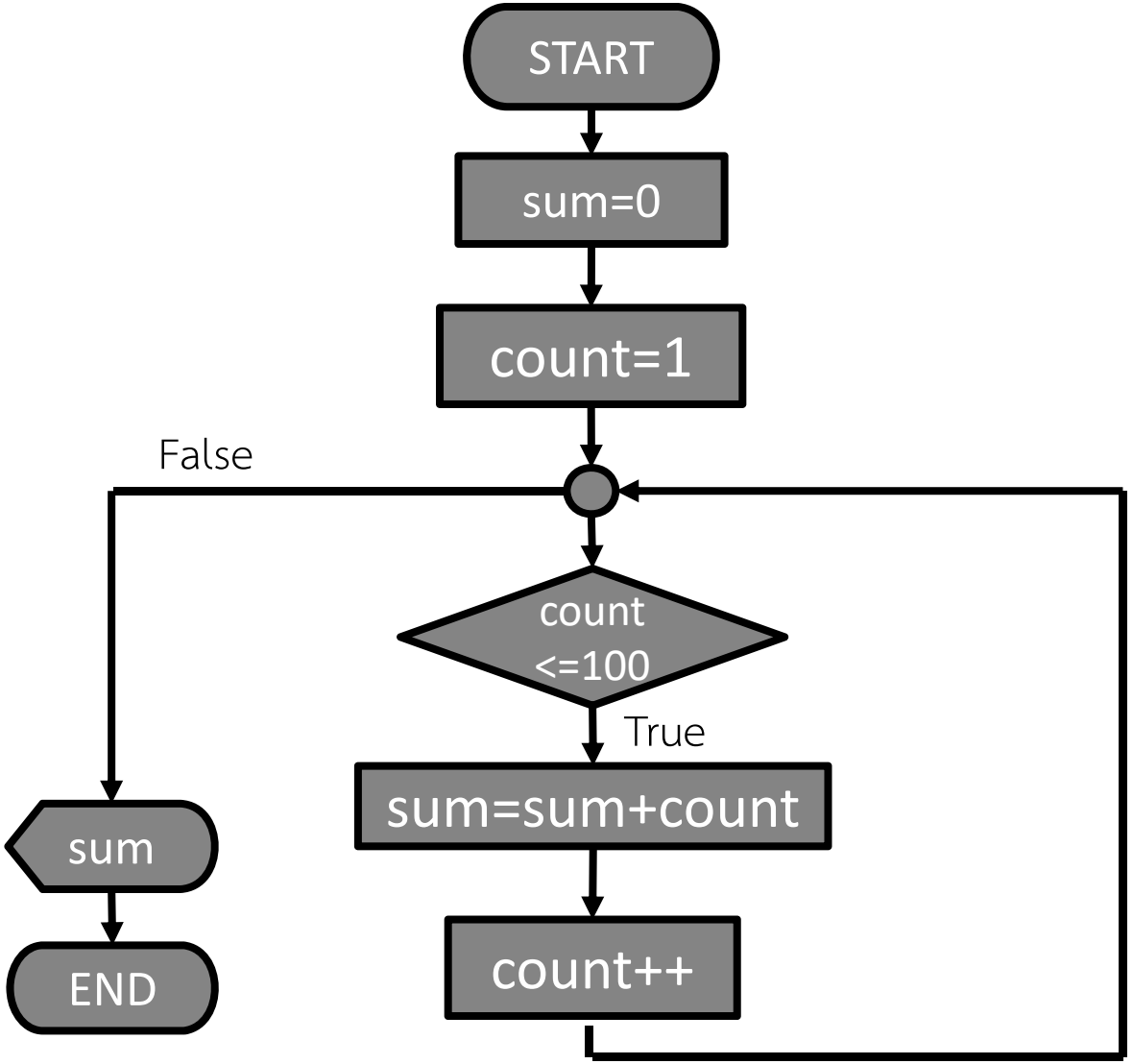
  - Program summation and keep value into variable and increase to 100.

- **Variable Define**

  count integer value to count number

  sum integer value to keep summation

Example : Program to display the summation of numbers 1 to 100(for)



Program to display the summation of numbers 1 to 100

(for)

```
#include<stdio.h>
int main()
{
   int sum = 0, count;
   for (count=1; count<=100; count++)
   {
        sum = sum + count;
   }
   printf (“Summation of 1 to 100 = %d”, sum);
   return 0;
}
```

Example : Program to show a-z (for)

Write a Flowchart and a Program to show a-z on the display by use for statement.

- **Output Analysis**

  - Show a-z on the display.

```
a b c d e f g h i j k l m n o p q r s t u v w x
y z
```

- **Input Analysis**

  - No

Example : Program show a-z (for)

- **Process Analysis**

  Program to show alphabet a-z by increase a variable 1 at each loop.(Use ASCII Code)

- **Variable Define**

  letter is character variable

Exercise

1. Write a program to show ASCII code from 33 to 55

Decimal	ASCII
33	!
34	“
35	#
…	
…	
55	7

Exercise

2. Write a program to get a value from user for calculate summation of squared numbers until get value equal 0 from user

Enter a number : 2

Enter a number : -5

Enter a number : 0

Result : 29

Exercise

3. Which one is infinite loop program

define int i=0

3.1 for (i=0; i>0; i++) printf (“%d”, i);

3.2 for (i=0; i%2!=0; i+=2) puts (“a”);

3.3 while (i<7) printf (“%d”, i--);

3.4 do {

```
        i+=3;
} while (i%3==0);
```

Example : Program to show 2 times (multiplication) table (for)

Write a Flowchart and a Program to show 2 times table

- **Output Analysis**

  - 2 times (multiplication) table

- **Input Analysis**

  - No

- **Process Analysis**

  - Loop statement for show 2 times table

Example : Program to show 2 times table (for)

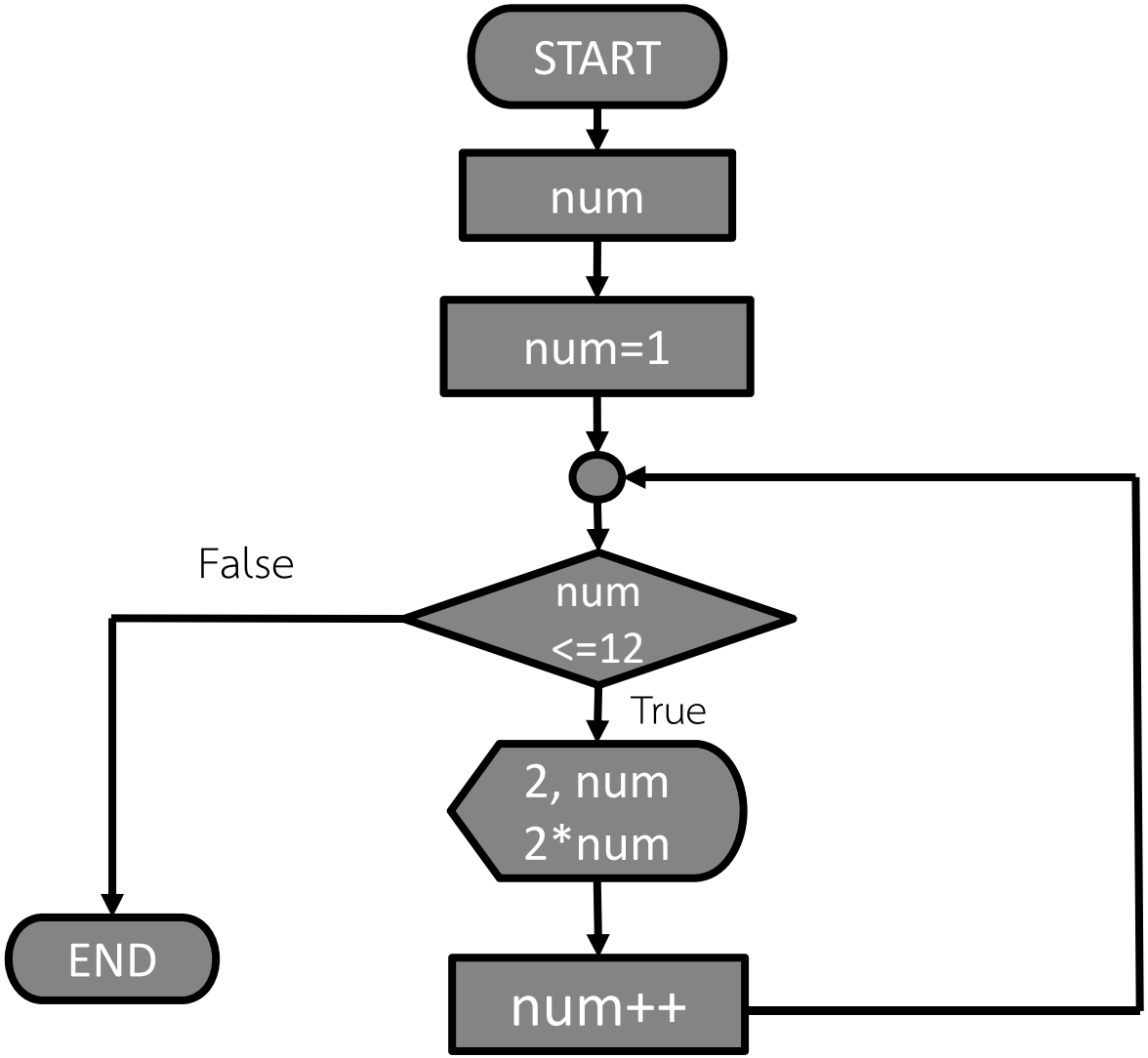
```
2 *  1 = 2
2 *  2 = 4
2 *  3 = 6
...
2 * 12 = 24
```

} 2 * num = 2*num

- **Variable Define**

  numis the integer variable for counting number 1-12.

Example : Program to show 2 times table (for)



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Example : Program to show 2 times table (for)

```
#include<stdio.h>
int main()
{
        int num;
        printf (“Multiplication table\n”);
        for (num=1; num<=12; num++)
        {
                printf (“%4d * %-2d = %-3d\n”, 2, num, 2*num);
        }
        return 0;
}
```

Example : Program to show 2 times table (for)

```
Multiplication table
    2 * 1  = 2
    2 * 2  = 4
    2 * 3  = 6
    2 * 4  = 8
    2 * 5  = 10
    2 * 6  = 12
    2 * 7  = 14
    2 * 8  = 16
    2 * 9  = 18
    2 * 10 = 20
    2 * 11 = 22
    2 * 12 = 24
```


Reference..www.ce.kmitl.ac.th King Mongkut's Institute of Technology Ladkrabang

How to select for, while, do-while

- **for** in case of knowing exactly the number of loop statements.
- **while** in case of considering the condition before starting the loop statement.
- **do-while** in case of considering the condition after starting the loop statement.

Example : Program shows number 0..100 (while)

```
#include<stdio.h>
int main()
{
        int count = 0;
        printf (“Show number from 0 to 100\n\n”);
        while (count<=100)
        {
                printf (“%d”, count);
                count++;
        }
        return 0;
}
```

Example : Program shows Even number 0...100 (while+if)

From last example change to

Write a Program to show the Even number between 0-100 We can edit from the last program,

Last program shows the number by use this command

```
printf ("%d", count);
```

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 ...

All value counted when the value is lower or equal 100 from while command.

0 2 4 6 8 10 12 14 16 18 20 ...

Example : Program shows Even number 0...100 (while+if)

Last program

```
while (count<=100)
{
        printf (“%d”, count);
        count++
}
```

```
0  1  2  3  4  5  6  7 ...
```

Edit by add condition if count is Even number will use this command

```
printf (“%d”, count);
```

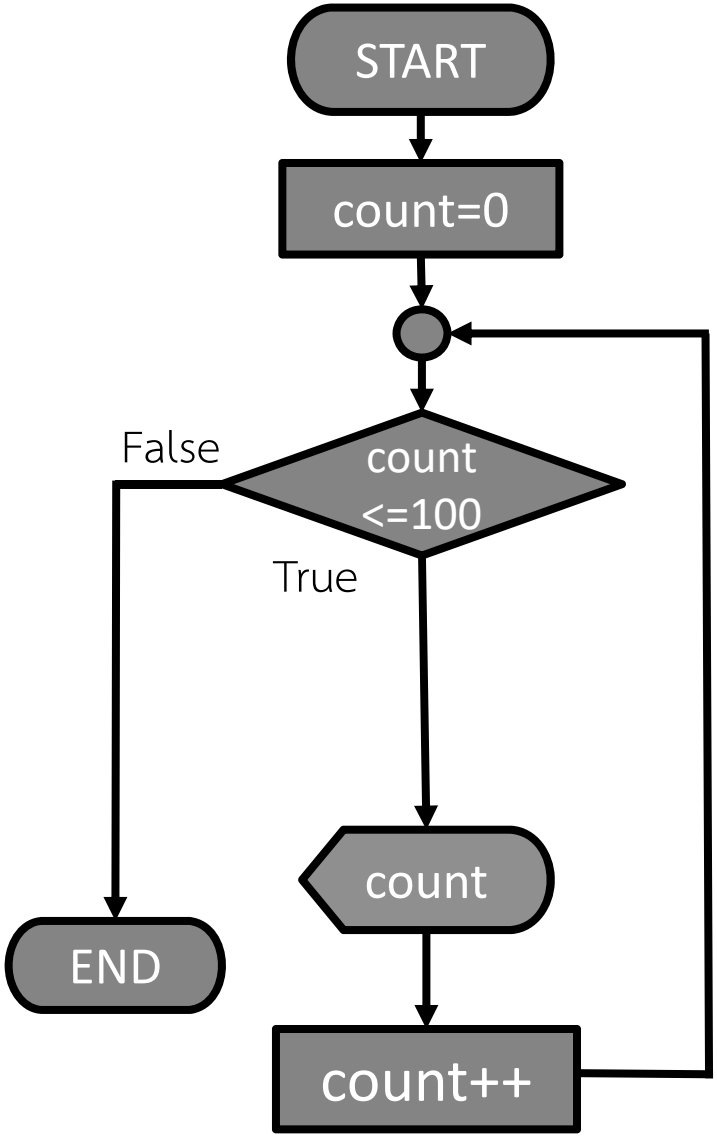
```
while (count<=100)
{
        if (count%2 == 0)
            printf (“%d”, count);

        count++
}
```

```
0     2     4     6 ...
```

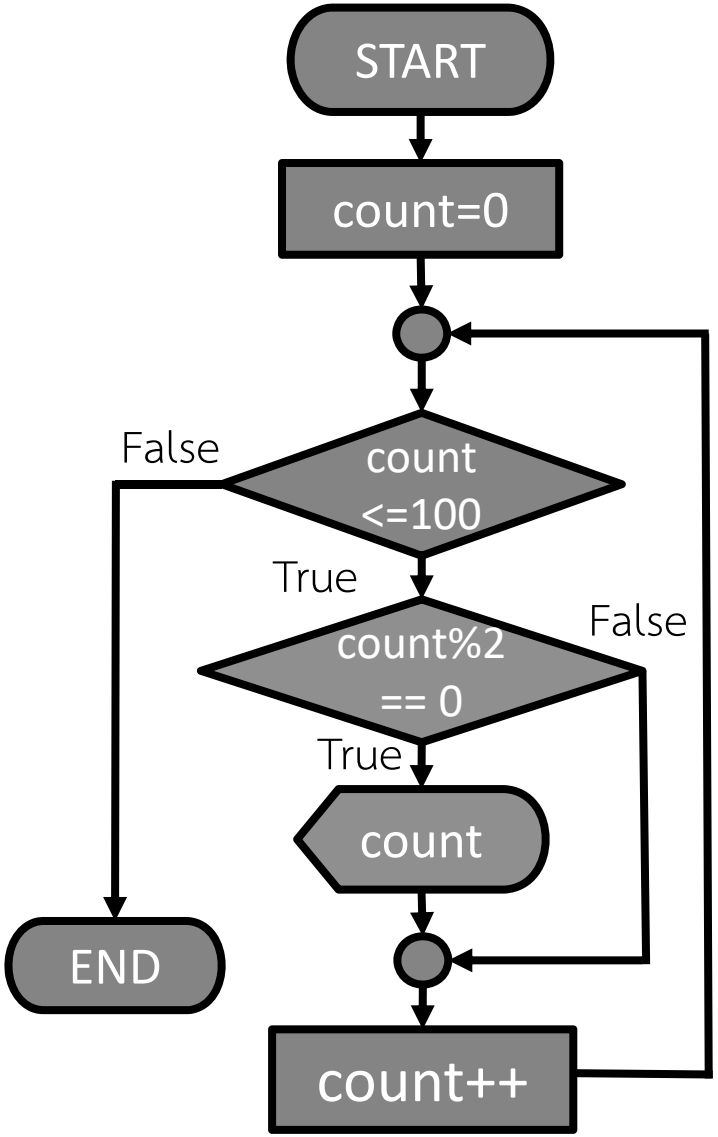
Example : Program shows Even number 0...100 (while+if)

```
#include<stdio.h>
int main()
{
        int count = 0;
        printf (“Show even number from 0 to 100\n\n”);
        while (count<=100)
        {
                if (count%2 == 0)
                        printf (“%d”, count);
                count++;
        }
        return 0;
}
```

Shows number 0-100



Shows Even number 0-100



Example : Program to check number of vowels (for)

Write a Flowchart and a Program to get 10 Lowercase characters then check how many vowel and not vowel.

- **Output Analysis**

  - Number of vowel and not vowel

- **Input Analysis**

  - 10 Lowercase characters from user

Example : Program to check number of vowels (for)

- **Process Analysis**

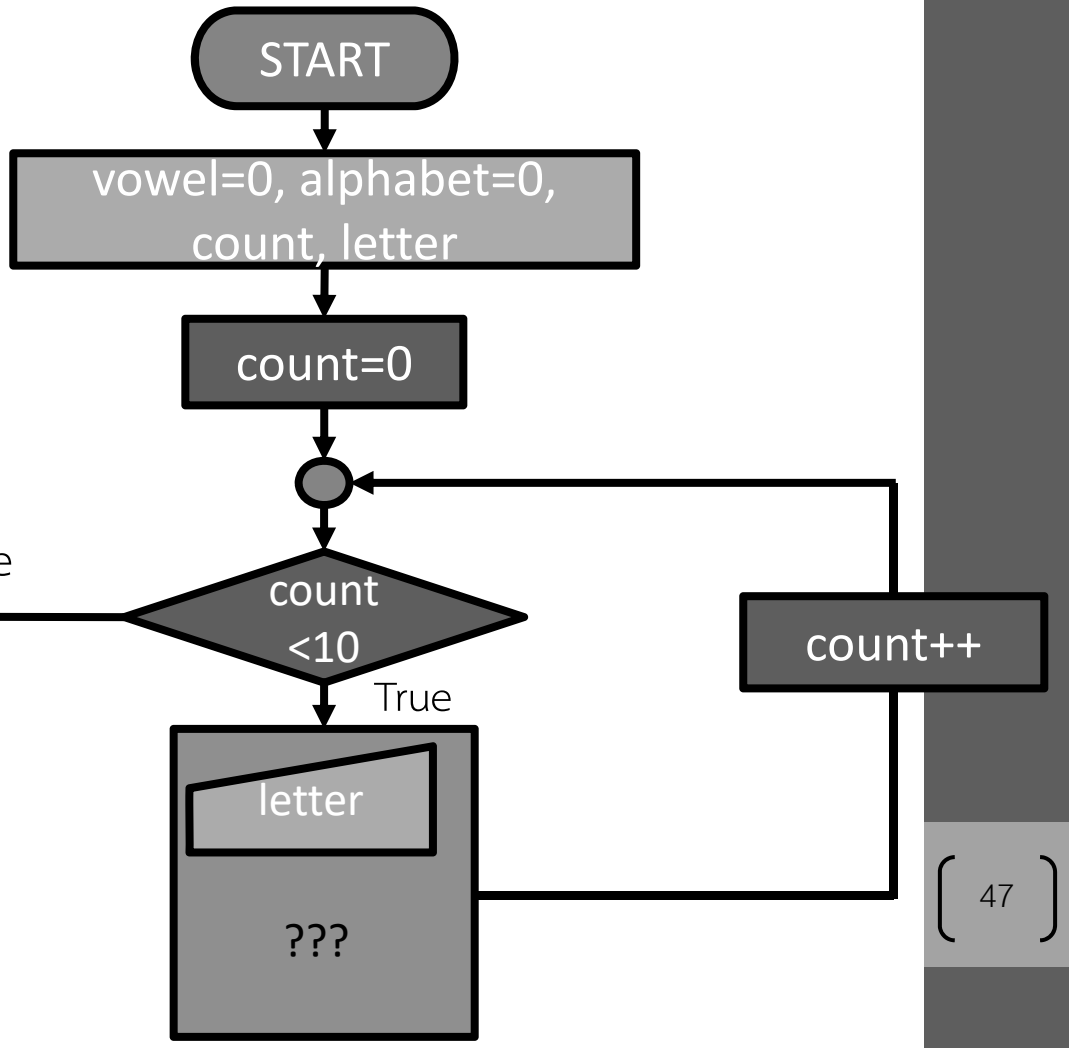
  - Loop statement to get number of characters and check. Is it vowel or not then count until 10.

- **Variable Define**

vowel	is the integer variable for counting number of vowel.
alphabet	is the integer variable for counting the number of not vowel.
count	is the integer variable for counting input character. Is it 10 or not?
letter	is the character variable for getting a character.

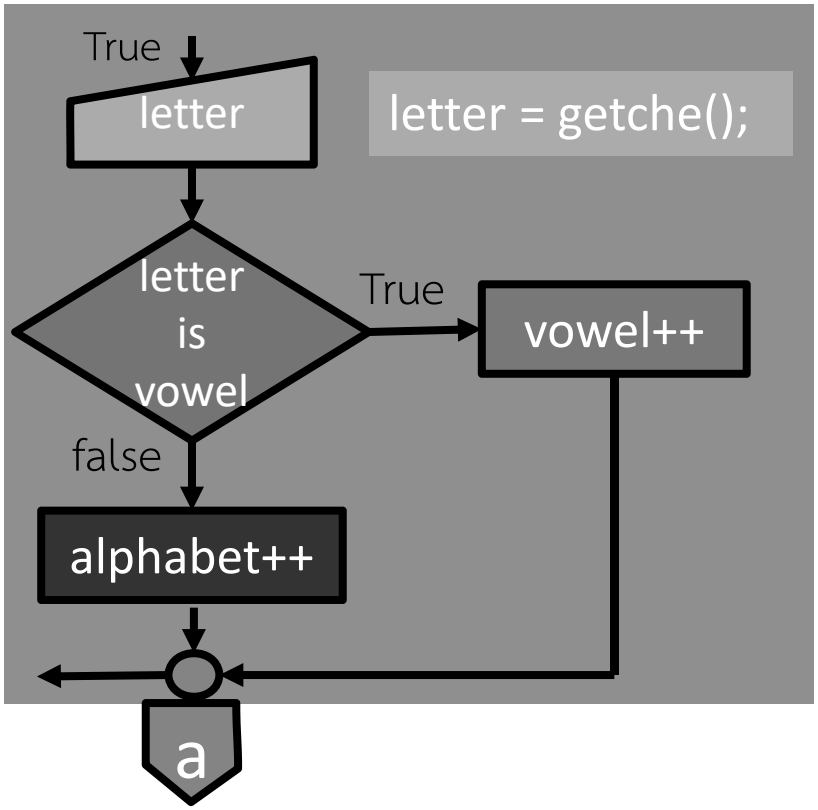
Example : Program to check number of vowels (for)

```
int    vowel=0, alphabet=0, count;
char  letter;
```




```
for (count=0; count<10; count++)
{
    letter = getche();
    ???

}
```

Example : Program to check number of vowels (for)




```
if ((letter=='a') || (letter=='e') || (letter=='i') || (letter=='o') || (letter=='u'))
    vowel++;
else
    alphabet++;
```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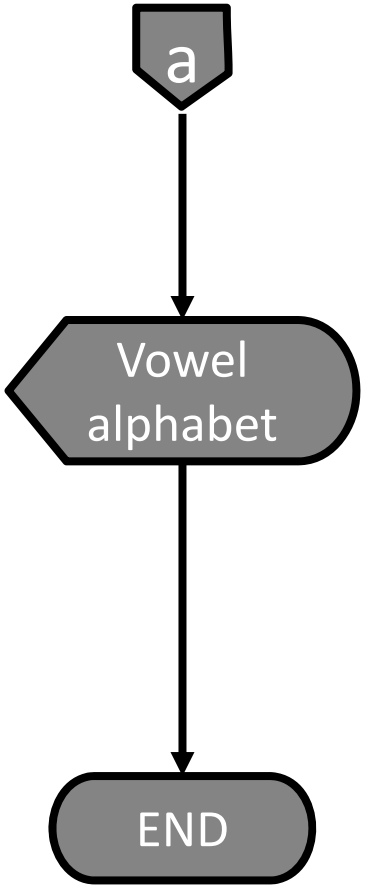
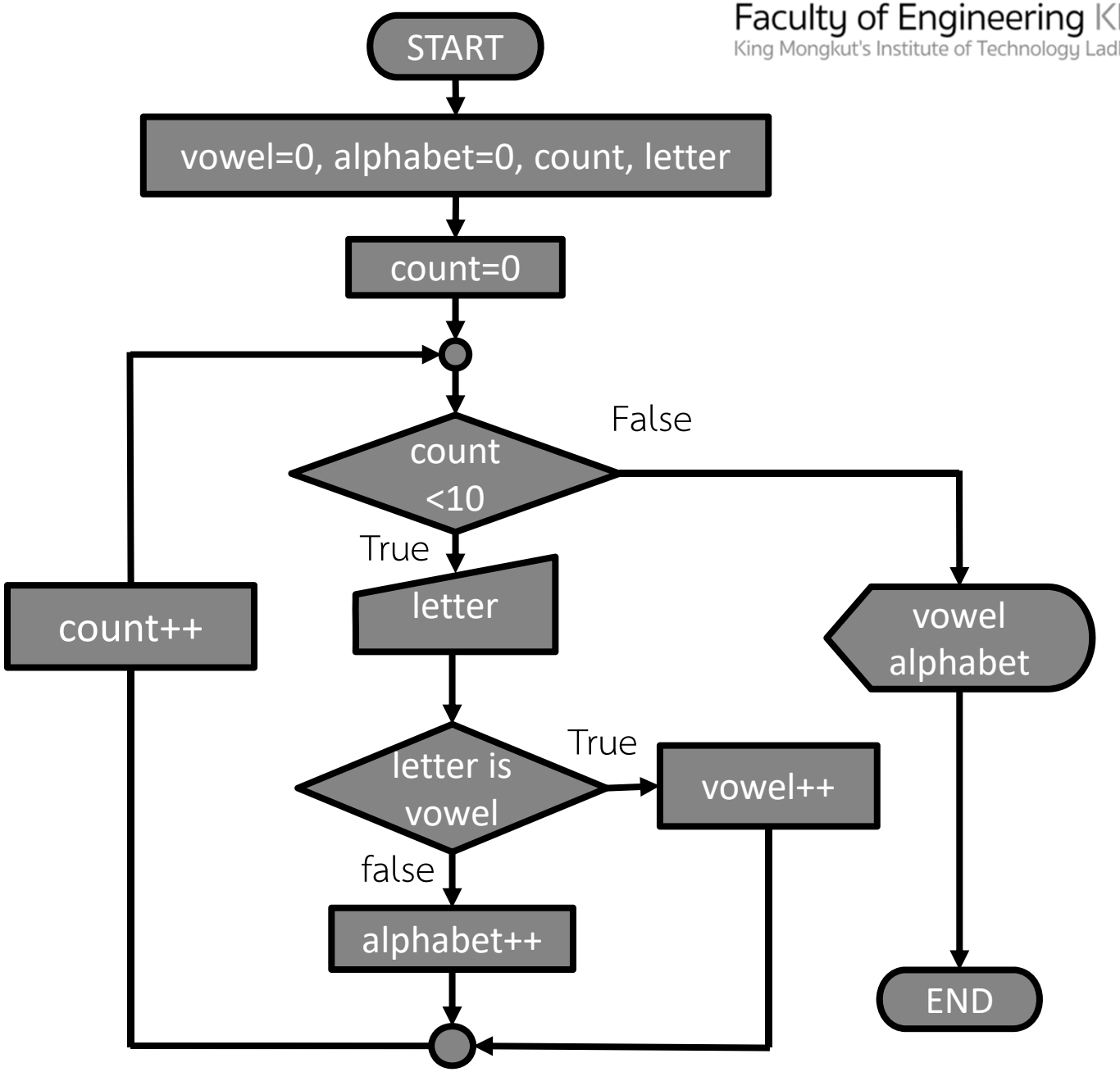
Example : Program to check number of vowels (for)




```
printf  (“\n***Result***\n”);
printf  (“Vowel  (a, e, i, o, u) = %d\n”, vowel);
printf  (“Other letter  = %d”, alphabet);
```


START
vowel=0, alphabet=0, count, letter
count=0
count <10
False
True
letter
count++
vowel alphabet
letter is vowel
True
vowel++
false
alphabet++
END

Example : Program to check number of vowels (for)

```
#include<stdio.h>
#include<conio.h>
int main()
{
        int vowel=0, alphabet=0, count;
        char letter;
        for (count=0; count<10; count++)
        {
        printf (“\nEnter letter a-z : ”);
        letter = getche();
        if ((letter==‘a’) || (letter==‘e’) || (letter==‘i’) || (letter==‘o’) || (letter==‘u’))
                vowel++;
        else
                alphabet++;
        }
```

Example : Program to check number of vowels (for)

```
printf (“\n***Result***\n”);
printf (“Vowel (a, e, i, o, u)  = %d\n”, vowel);
printf (“Other letter           = %d, alphabet);
return 0;
}
```

Example : Program for display edge of square

Write a flowchart and a program to display square with dimension n x n while n is the decimal value that user enter by keyboard.

```
Please enter number : 4
Output
****
*  *
*  *
****
```

```
Please enter number : 9
Output
*********
*       *
*       *
*       *
*       *
*       *
*       *
*       *
*********
```

Example : Program to display the edges of square

- **Output Analysis**

- Edges of square that its dimension equal to the decimal number that user enter to the keyboard.

- **Input Analysis**

- Decimal number that user enter to the program.

- **Process Analysis**

- The program wait the decimal input value from user.

- The program loops in order to display '*' to create the square.

Example : Program to display the edges of square

- **Process Analysis (continue)**

  Command the process as shown below:

  line 1 : Display ‘\n’ and display ‘*’ only the edge of square and the remaining display ‘ ’

  line 2 : Display ‘\n’ and display ‘*’ only the edge of square and the remaining display ‘ ’

  .....

  line n : Display ‘\n’ and display ‘*’ only the edge of square and the remaining display ‘ ’

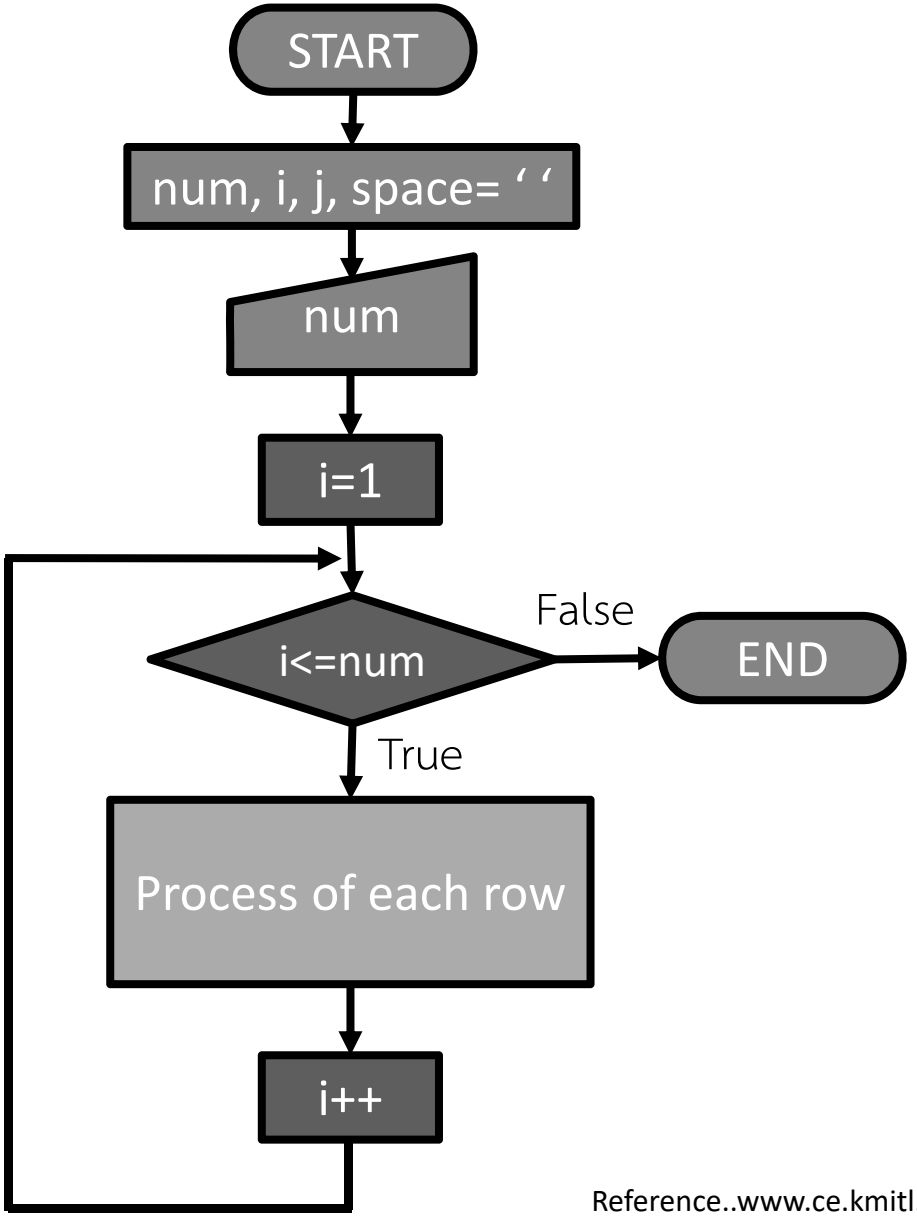
- **Variable Define**

  num is the integer variable for storing the entered number from the user.

  i is the integer variable for counting the number of line.

  j is the integer variable for counting the character in each line.

Example : Program to display the edges of square




```
int     num, i, j;
char    space=‘ ‘;
```

```
printf (Enter number: “);
scanf  (“%d”, &num);
```

```
for (i=1; i<=num; i++)
{
    Process of each row
}
```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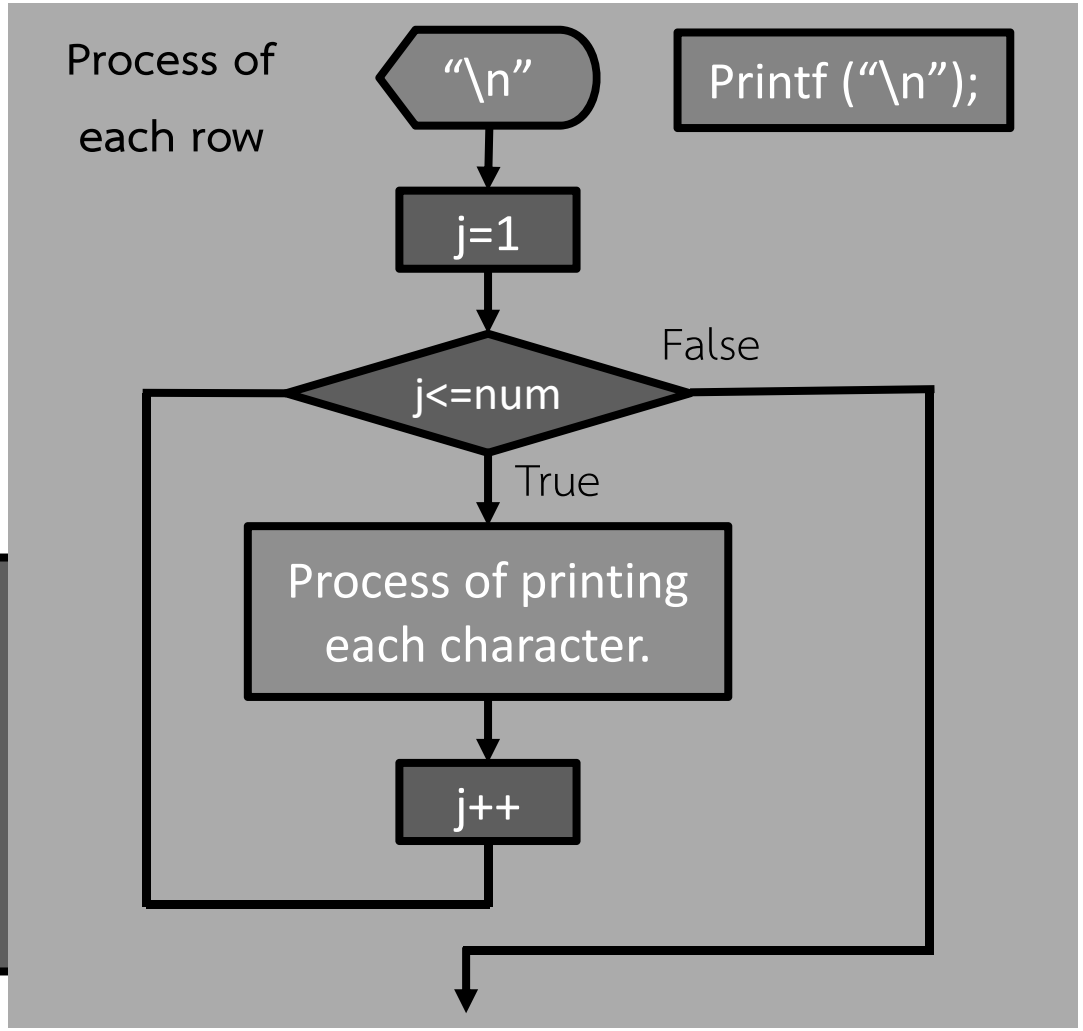
Example : Program to display the edges of square

```
for (j=1; j<=num; j++)
{
    Process of printing
    each character.
}
```



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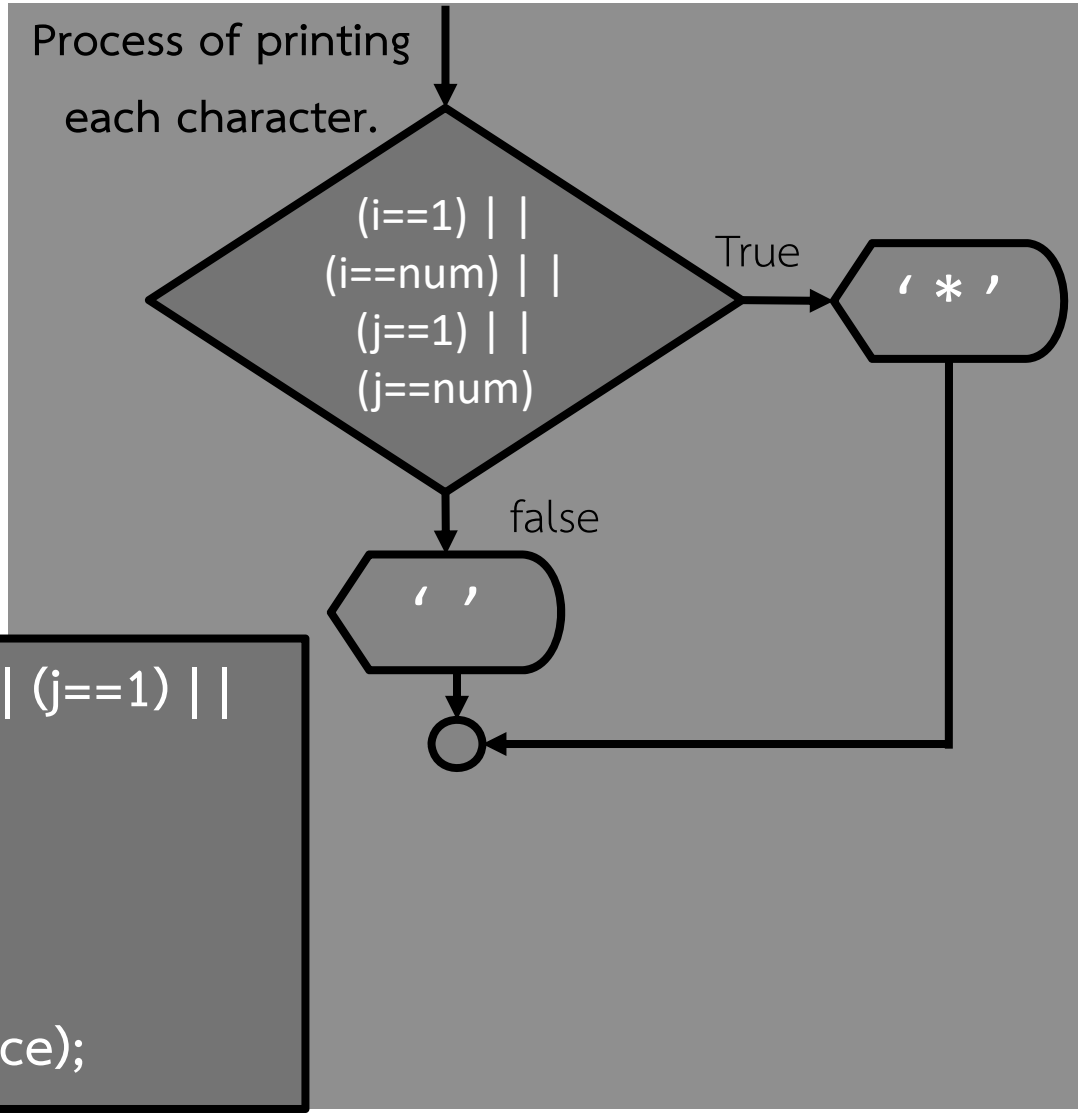
Example : Program to display the edges of square




```
if (i==1) || (i==num) || (j==1) ||
(j==num)
        printf ("*");
else
        printf ("%c", space);
```

Example : Program to display the edges of square

```
#include<stdio.h>
int main ()
{
      int    num, i, j;
      char  space=‘ ‘;
      printf(“Enter number : “);
      scanf(“%d”, &num);
      //continue
```

Example : Program to display the edges of square

```
for (i=1; i<=num; i++)
      {
      printf (“\n”);
      for (j=1; j<=num; j++)
           {
             if (i==1 || i==num || j==1 || j==num)
                 printf (“*”);
             else
                 printf (“%c”, space);
           }
      }
      return 0;
}
```

Exercise

1. Write a program to input number “1 2 3”

   If user enter 1, display “Hello” to the screen.

   If user enter 2, display “Thank you” to the screen.

   If user enter 3, display “Good bye” to the screen.

   If user doesn’t enter 1 or 2 or 3, display “Sorry” to the screen.

```
Enter a number : 1
Hello
Enter a number : 2
Thank you
Enter a number : 9
Sorry
Enter a number : 0
Sorry
Enter a number : 3
Good bye
```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Exercise

2. Write a program to input the numbers between 2 to 25 then display the multiplication results.

If the numbers that user enter to the program don't exist in the provider range, the program will request user to enter the number again.

```
Enter a number : 29
Enter a number : 4
4 * 1     = 4
4 * 2     = 8
4 * 3     = 12
...
4 * 12    = 48
```

Exercise

3. Write a program to input a string then display that string every 10 characters in each line.

```
Enter a sentence :
You are the wind beneath my wings.

Result :
You are th
e wind ben
eath my wi
ngs.
```