

Looping



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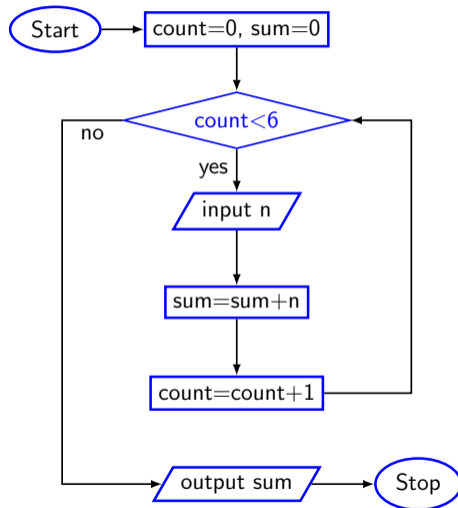
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Loops

- Group of statements that are executed repeatedly while some condition remains true
- Each execution of the group of statements is called an **iteration** of the loop

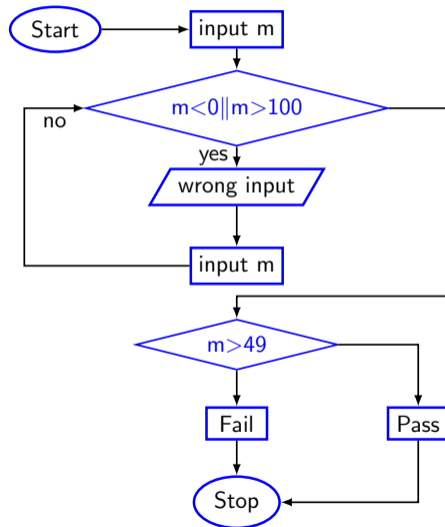
Example: Sum



Example: Pass/Fail

- Given an exam marks as input, display the appropriate message based on the rules below:
 - If marks is greater than 49, display "PASS", otherwise display "FAIL"
 - However, for input outside the 0-100 range, display WRONG INPUT and prompt the user to input again until a valid input is entered

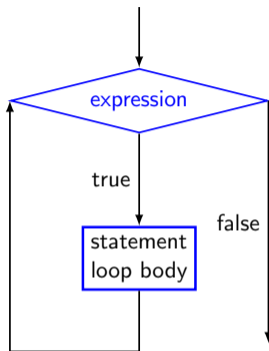
Example: Pass/Fail



Looping: while statement

```
while(expression)  
    statement;
```

```
while(expression){  
    statement;  
}
```



- The condition to be tested is any expression enclosed in parentheses. The expression is evaluated, and if its value is non-zero, the statement is executed. Then the expression is evaluated again and the same thing repeats. The loop **terminates** when the expression evaluates to 0.

Example

```
int i = 1, n;  
scanf("%d", &n);  
while(i <= n) {  
    printf ("Line no :  %d\n",i);  
    i = i + 1;  
}
```

Example

```
int weight;  
scanf("%d", &weight);  
while(weight > 65) {  
    printf ("Go, excercise, then come back\n");  
    printf ("Enter your weight: ");  
    scanf("%d", &weight);  
}
```


Sum of first N natural numbers

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```
int N, count=1, sum=0;  
scanf("%d", &N);
```

Sum of first N natural numbers

```
int N, count=1, sum=0;  
scanf("%d", &N);  
while(count <= N) {
```

Sum of first N natural numbers

```
int N, count=1, sum=0;
scanf("%d", &N);
while(count <= N) {
    sum = sum + count;
```

Sum of first N natural numbers

```
int N, count=1, sum=0;
scanf("%d", &N);
while(count <= N) {
    sum = sum + count;
    count = count + 1;
}
printf("Sum=%d\n", &sum);
```

Compute $\sum_{i=1}^N i^2$

```
void main(){  
    int N,count=1, sum=0;  
    scanf("%d", &N);
```

Compute $\sum_{i=1}^N i^2$

```
void main(){  
    int N,count=1, sum=0;  
    scanf("%d", &N);  
    while(count <= N) {
```

Compute $\sum_{i=1}^N i^2$

```
void main(){  
    int N,count=1, sum=0;  
    scanf("%d", &N);  
    while(count <= N) {  
        sum = sum + count*count;  
    }
```


Compute $\sum_{i=1}^N i^2$

```
void main(){
    int N,count=1, sum=0;
    scanf("%d", &N);
    while(count <= N) {
        sum = sum + count*count;
        count = count + 1;
    }
    printf("Sum=%d\n", sum);
}
```

Compute GCD

```
void main(){
    int A,B,temp;
    scanf("%d%d", &A,&B);
    if (A>B){
        temp=A; A=B; B=temp;
    }
}
```

Compute GCD

```
void main(){
    int A,B,temp;
    scanf("%d%d", &A,&B);
    if (A>B){
        temp=A; A=B; B=temp;
    }
    while(B%A!=0) {
        temp = B% A;
        B = A;
        A = temp;
    }
    printf("GCD=%d\n", A);
}
```

Double your money

- Suppose your Rs 10000 is earning interest at 1% per month. How many months until you double your money ?

```
void main(){  
    double money=10000.0;  
    int n=0;
```

Double your money

- Suppose your Rs 10000 is earning interest at 1% per month. How many months until you double your money ?

```
void main(){
    double money=10000.0;
    int n=0;
    while(money<20000) {
        money = money * 1.01;
        n++;
    }
    printf("Months=%d\n", n);
}
```

Maximum of positive numbers

```
void main(){
    double max=0.0,n;
    printf("Enter +ve numbers, end with a negative number\n");
    scanf("%lf",&n);
    while(n>0) {
        if(n>max) max = n;
        scanf("%lf",&n);
    }
    printf("Maximum=%d\n", max);
}
```

Find the sum of digits of a number

```
void main(){
    int sum=0,n;
    scanf("%d",&n);
    while(n!=0) {
        sum = sum + (n%10);
        n = n / 10;
    }
    printf("Sum=%d\n", sum);
}
```

Looping: for statement

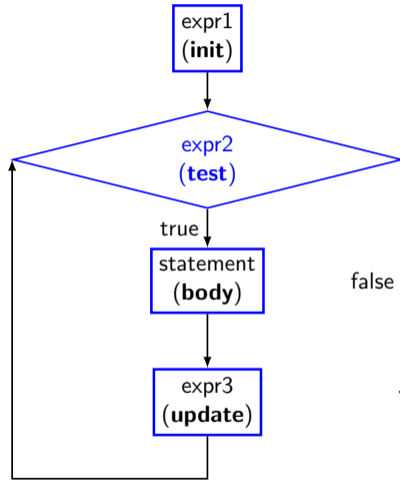
- Most commonly used looping structure in C

```
for(expr1;expr2;expr3)  
    statement;
```

```
for(expr1;expr2;expr3){  
    statement;  
}
```

- `expr1` (init): initialize parameters
- `expr2` (test): test condition, loop continues if expression is non-0
- `expr3` (update): used to alter the value of the parameters after each iteration
- `statement` (body): body of loop

Looping: for statement



Computing factorial

```
void main(){
    int n,count,prod=1;
    scanf("%d",&n);
    for(count=1;count<=n;++count) {
        prod = prod * count;
    }
    printf("Factorial=%d\n", prod);
}
```

Computing e^x series upto n terms

```
void main(){
    int n,count;
    float x,term=1.0,sum=0.0;
    scanf("%f",&x);
    scanf("%d",&n);
    for(count=1;count<=n;++count) {
        sum += term;
        term *= x/count;
    }
    printf("Exp(x,n)=%d\n",sum);
}
```

Computing e^x series upto 4 decimal places

```
void main(){
    int count;
    float x,term=1.0,sum=0.0;
    scanf("%f",&x);
    for(count=1;term>=0.0001;++count) {
        sum += term;
        term *= x/count;
    }
    printf("Exp(x)=%d\n",sum);
}
```

Equivalence of for and while

```
for(expr1;expr2;expr3) {  
    statement;  
}
```

```
expr1;  
while(expr2){  
    statement;  
    expr3;  
}
```

Sum of first N natural numbers

```
int N, count=1, sum=0;
scanf("%d", &N);
while(count <= N) {
    sum = sum + count;
    count = count + 1;
}
printf("Sum=%d\n", &sum);
```

```
int N, count=1, sum=0;
scanf("%d", &N);
for(; count<=N; count++) {
    sum = sum + count;
}
printf("Sum=%d\n", &sum);
```

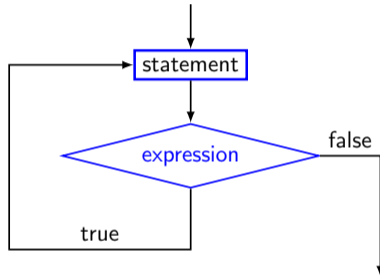
Some observation on for

- Initialization, loop-continuation test, and update can contain arithmetic expressions
`for (k = x; k <= 4 * x * y; k += y / x)`
- Update may be negative (decrement)
`for (digit = 9; digit >= 0; --digit)`
- If loop continuation test is initially 0 (false)
 - Body of for structure not performed
 - No statement executed
 - Program proceeds with statement after for structure

Looping: do-while statement

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

```
do{  
    statement  
}while(expression);
```



Example

- Prompt user to input "month" value, keep prompting until a correct value of month is given as input

Example

- Prompt user to input "month" value, keep prompting until a correct value of month is given as input

do

```
printf("Please input month[1-12]");
```

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

```
}while((month<1)|| (month>12));
```