Loops

while statements

```
while(expression){
    statements
}
```

while statements

```
int counter = 1;
while (counter <= 10) {
    printf("%d", counter );
    counter ++;
}
```

while statements

```
int counter = 1;
```

initialization of control variable

while statements

```
while (counter <= 10) {
}
```

Iteration condition

while statements

```
while (counter <= 10) {
    counter ++;
}
```

Increment/decrement by which control variable is modified each time

while statements

```
int counter = 1;
while (counter <= 10) {
    printf("%d", counter );
    counter ++;
}
```

Body of the Loop

while statements

```
int counter = 1;
while (counter <= 10) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	1

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	1

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	1

```
1
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	2

```
1
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	2

```
1
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	2

```
1
2
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	3

```
1
2
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	3

```
1
2
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	3

```
1
2
3
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	4

```
1
2
3
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	4

```
1
2
3
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	4

```
1
2
3
4
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	5

```
1
2
3
4
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	5

```
1
2
3
4
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	5

```
1
2
3
4
5
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	6

```
1
2
3
4
5
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	6

```
1
2
3
4
5
```

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d\n", counter );
    counter ++;
}
```

counter	6

```
1
2
3
4
5
```

Summation of series(1)

Find the summation of the first n terms of the following series:

$$1 + 3 + 5 + \ldots$$

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5

Total number of terms

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1

Keeps track of number of terms

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1
sum	0

Keeps track of summation of terms

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1
sum	0
term	1

Keeps track of current term

Why term is initialized to 1?
→ First term of the series is 1

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1
sum	0
term	1

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1
sum	1
term	2

Sum upto
1+

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	1
sum	1
term	3

Update the next term which is 3

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	2
sum	1
term	3

Update the control variable

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	2
sum	1
term	3

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	2
sum	4
term	3

Sum upto
1 + 3

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	2
sum	4
term	5

Update the next term which is 5

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	3
sum	4
term	5

Update the control variable

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	6
sum	25
term	11

Summation of series(1)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(counter <= n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5
counter	6
sum	25
term	11

Summation of series(2)

Find the summation of the following series till the sum is less than 150:

$$1 + 3 + 5 + \ldots.$$

Summation of series(2)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    while(sum < n){
        sum += term;
        term += 2;
        counter++;
    }
    printf("%d\n", sum);
}
```

n	5

Maximum sum

Summation of series(3)

Find the summation of the following series till the sum is less than 150:

$$1 - 3 + 5 - \ldots.$$

Summation of series(3)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    int sign = 1;
    while(sum < n){
        sum += term * sign;
        term += 2;
        counter++;
        sign= sign * -1;
    }
    printf("%d\n", sum);
}
```

sign	1

Keeps track of the signs of the terms

Why is sign initialized to 1?
→ First term is positive

Summation of series(3)

Find the summation of the following series till the sum is less than 150:

$$1^2 - 3^2 + 5^2 - \ldots.$$

Summation of series(3)

```
int main(){
    int n;
    scanf("%d", &n);
    int counter = 1;
    int sum = 0;
    int term = 1;
    int sign = 1;
    int power = 2;
    while(sum < n){
        sum += pow(term, power) * sign;
        term += 2;
        counter++;
        sign= sign * -1;
    }
    printf("%d\n", sum);
}
```

power	2

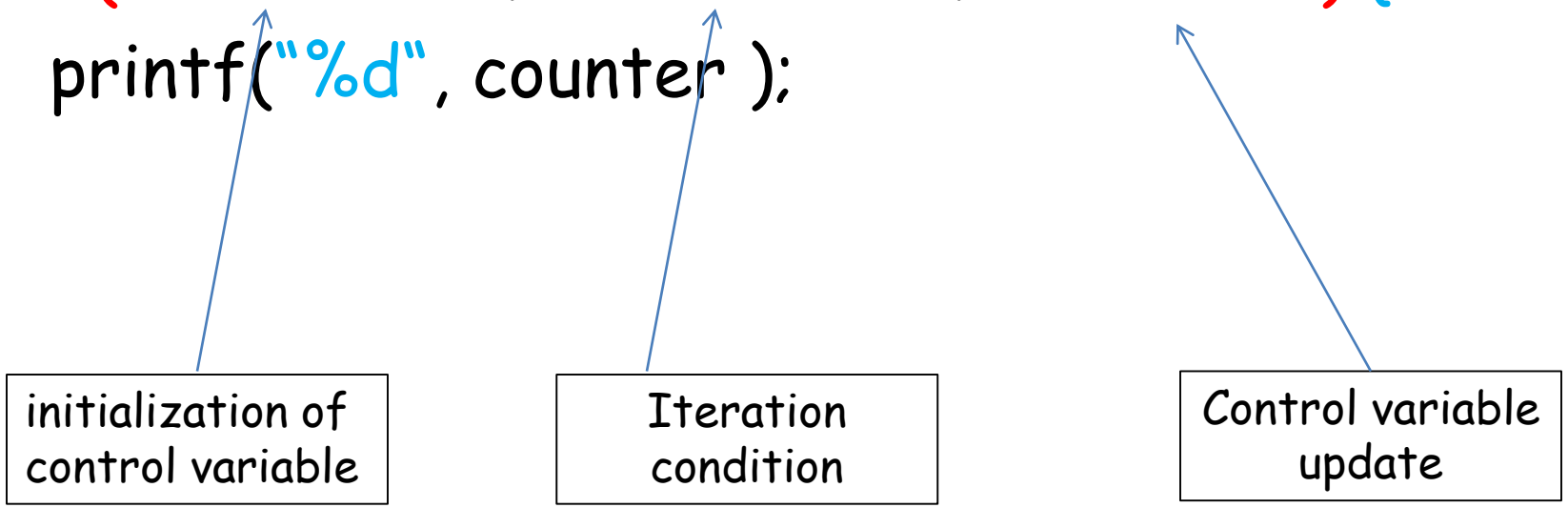
Keeps track of the power of the terms

while statements

```
int counter = 1;
while (counter <= 5) {
    printf("%d", counter );
    counter ++;
}
```

for statements

```
for (counter = 1 ; counter <= 5; counter++) {
    printf("%d", counter );
}
```



for statements

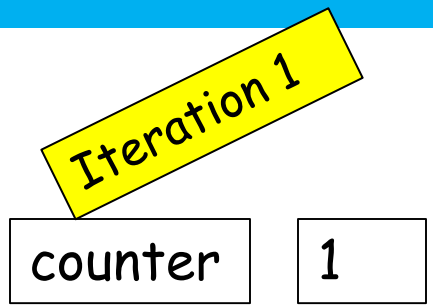
```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

Iteration 1

counter	1

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```



for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
   printf("%d", counter );
}
```

Iteration 1

counter	1

1

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

Iteration 1

counter	2

1

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

Iteration 2

counter	2

1

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
   printf("%d", counter );
}
```

Iteration 2

counter	2

```
1
2
```

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

Iteration 2

counter	3

```
1
2
```

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

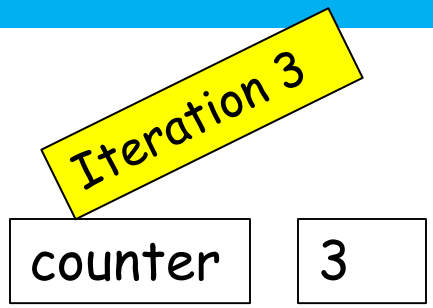
Iteration 3

counter	3

```
1
2
```

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
   printf("%d", counter );
}
```




```
1
2
3
```

for statements

```
for (counter = 1 ; counter <= 5; counter++)
{
    printf("%d", counter );
}
```

Iteration 3

counter	3

```
1
2
3
```