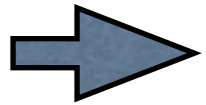


# Nested Loops

Explanation by Example

# Loops Within Loops



```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

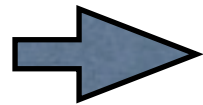
x = 1

y = Undef

Console

|

# Loops Within Loops



```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

x = 1

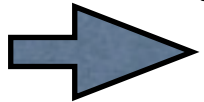
y = Undef

Console

|

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

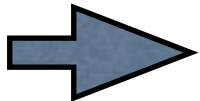
y = 1

Console

|

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

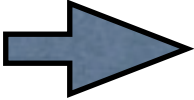
y = 1

Console

|

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

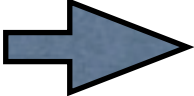
y = 1

Console

1 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

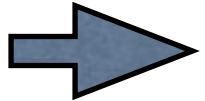
y = 2

Console

1 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1


y = 2

Console

1 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

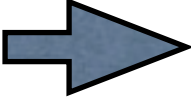
y = 2

Console

1 2 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

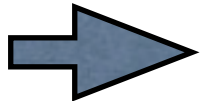
y = 3

Console

1 2 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

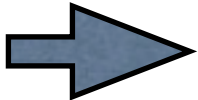
y = 3

Console

1 2 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

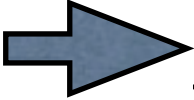
y = 3

Console

1 2 3 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

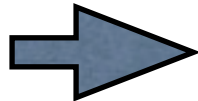
y = 4

Console

1 2 3 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

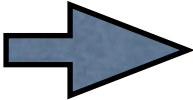
y = 4

Console

1 2 3 |

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 1

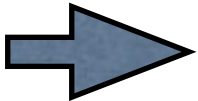
y = 4

Console

```
1 2 3
|
```

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



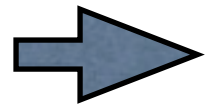
x = 2

y = 4

Console

```
1 2 3
|
```

# Loops Within Loops



```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

x = 2

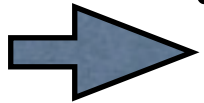
y = Undef

Console

```
1 2 3
|
```

# Loops Within Loops

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 2

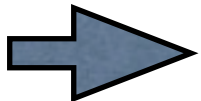
y = 1

Console

```
1 2 3
|
```

# Fast Forward...

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```



x = 6

y = Undef

## Console

```
1 2 3
2 4 6
3 6 9
4 8 12
5 10 15
|
```

# Rows and Columns

```
int x = 1;
while(x <= 5)
{
    int y = 1;
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

## Console

```
1 2 3
2 4 6
3 6 9
4 8 12
5 10 15
|
```

The outside loop is the number of rows  
The inside loop is the number of cols

# Common Mistake

```
int x = 1;
int y = 1;

while(x <= 5)
{
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

Console

|

# Common Mistake

```
int x = 1;
int y = 1;

while(x <= 5)
{
    while(y <= 3)
    {
        System.out.print(x * y + " ");
        y++;
    }
    System.out.println();
    x++;
}
```

## Console

```
1 2 3
|
```

**y stays at 4 after finishing first pass through  
outside loop!**

# Triangle Loops

```
int numCols = 5;

for(int row = 1; row <= 5; row++)
{
    for(int col = 1; col <= numCols; col++)
    {
        System.out.print("* ");
    }

    numCols--;
    System.out.println();
}
```

Console

|

# Triangle Loops

```
int numCols = 5;

for(int row = 1; row <= 5; row++)
{
    for(int col = 1; col <= numCols; col++)
    {
        System.out.print("* ");
    }

    numCols--;
    System.out.println();
}
```

## Console

```
* * * * *
* * * *
* * *
* *
*
|
```

# Alternate Version

```
for(int row = 1; row <= 5; row++)  
{  
    for(int col = 1; col <= 6 - row; col++)  
    {  
        System.out.print("* ");  
    }  
  
    System.out.println();  
}
```

## Console

```
* * * * *  
* * * *  
* * *  
* *  
*  
|
```

# Double Loops

```
int numAs = 0;
int numBs = 5;

for(int row = 1; row <= 5; row++)
{
    for(int i = 0; i < numAs; i++)
        System.out.print("A");

    for(int i = 0; i < numBs; i++)
        System.out.print("B");

    numAs++;
    numBs--;
    System.out.println();
}
```

Console

|

# Double Loops

```
int numAs = 0;
int numBs = 5;

for(int row = 1; row <= 5; row++)
{
    for(int i = 0; i < numAs; i++)
        System.out.print("A");

    for(int i = 0; i < numBs; i++)
        System.out.print("B");

    numAs++;
    numBs--;
    System.out.println();
}
```

## Console

```
BBBBB
ABBBB
AABBB
AAABB
AAAAB
|
```

# Suggestions

- Use as many variables as you need
- Use whatever type of loop you are most comfortable with
- Try to write the inner loop before the outer loop (the outer loop just controls how many times the inner loop runs)