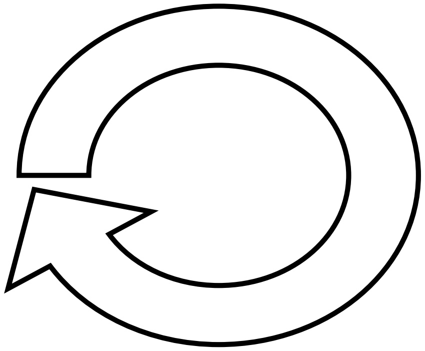
Looping Structures



The Plan

While not everyone understands:

1. Motivate loops
2. For loops
3. While loops
4. Do-while loops
5. Equivalence
6. Application of Simulated Collision
7. Practice Problems

Motivation

Why loop?

Sometimes you need to do things again, and again...and finally you get tired of typing.

Motivation

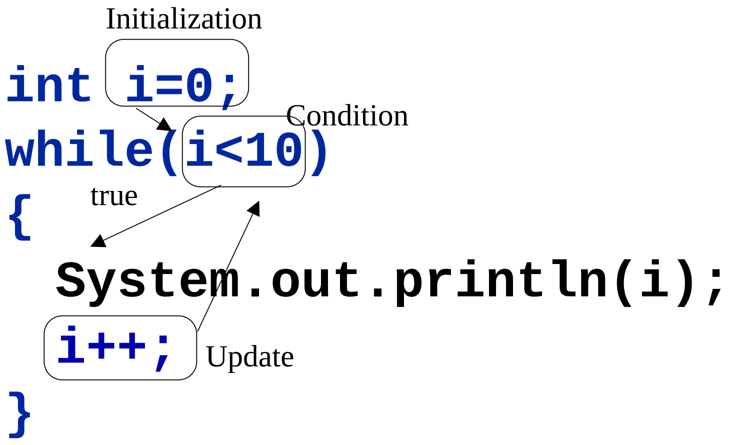
Okay, so that's not all. You also loop in order to:

- Group repeatedly executed code for uniformity
- Make the number of repetitions easily changeable
- Repeat events which the number of exectutions is known only dynamically
- Combine with selection statements to make more complex algorithms

while Loop

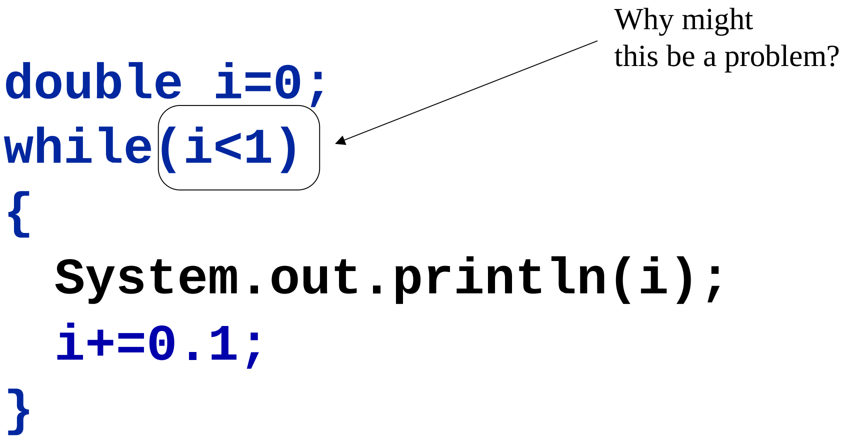
```
int i=0;
while(i<10)
{
  System.out.println(i);
  i++;
}
```

while Loop



```
int i=0;
while(i<10)
{
  System.out.println(i);
  i++;
}
```

while Loop



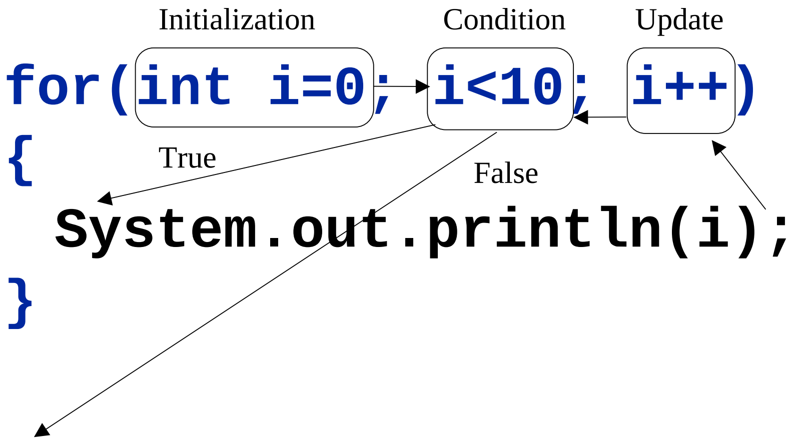
```
double i=0;
while(i<1)
{
  System.out.println(i);
  i+=0.1;
}
```

Why might
this be a problem?

for Loop

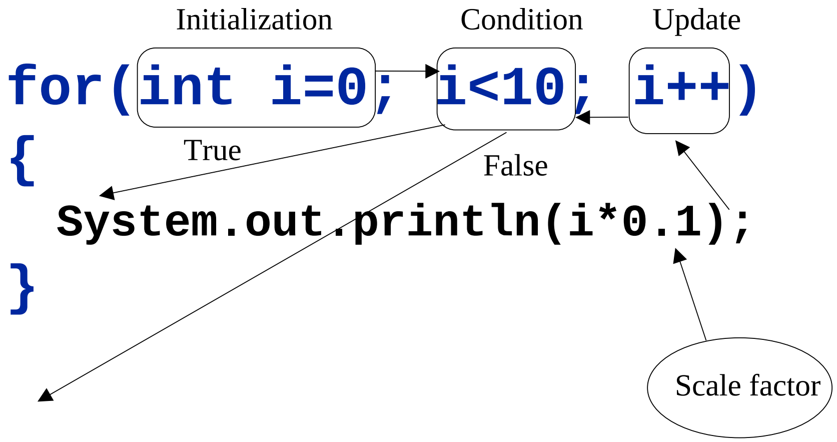
```
for(int i=0; i<10; i++)
{
  System.out.println(i);
}
```

for Loop



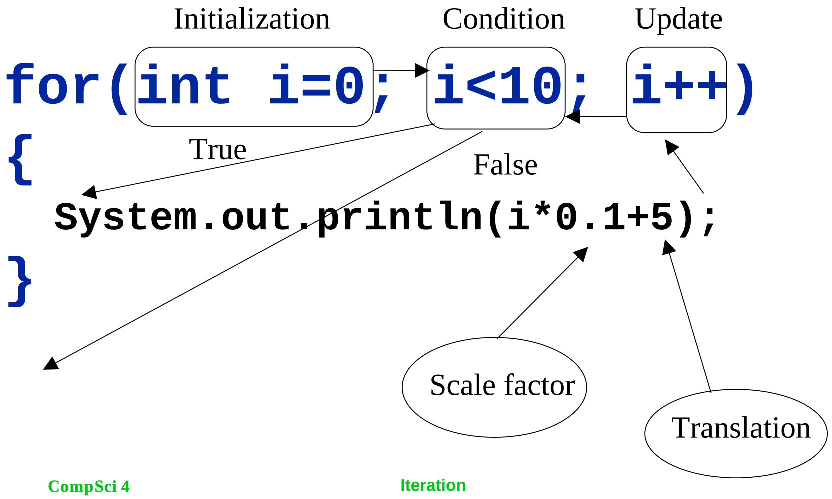
```
for(int i=0; i<10; i++)
{
  System.out.println(i);
}
```

for Loop



```
for(int i=0; i<10; i++)
{
  System.out.println(i*0.1);
}
```

for Loop



```
for(int i=0; i<10; i++)
{
  System.out.println(i*0.1+5);
}
```

Equivalence of Loops

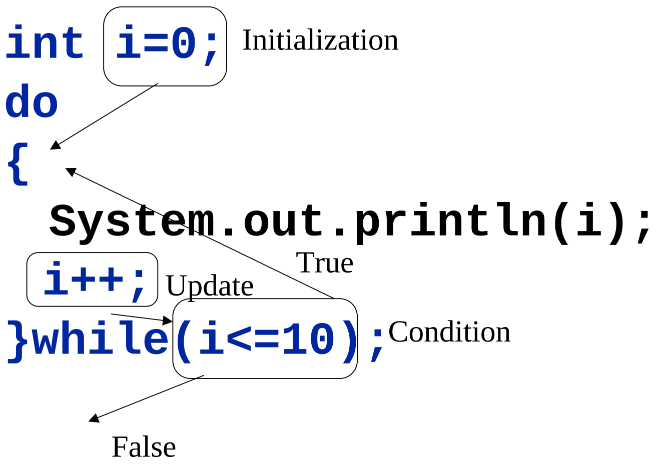
```
int i=0;
while(i<10)
{
  System.out.println(i);
  i++;
}
```

```
for(int i=0; i<10; i++)
{
  System.out.println(i);
}
```

do-while Loop

```
int i=0;
do
{
  System.out.println(i);
 i++;
}while(i<=10);
```

do-while Loop



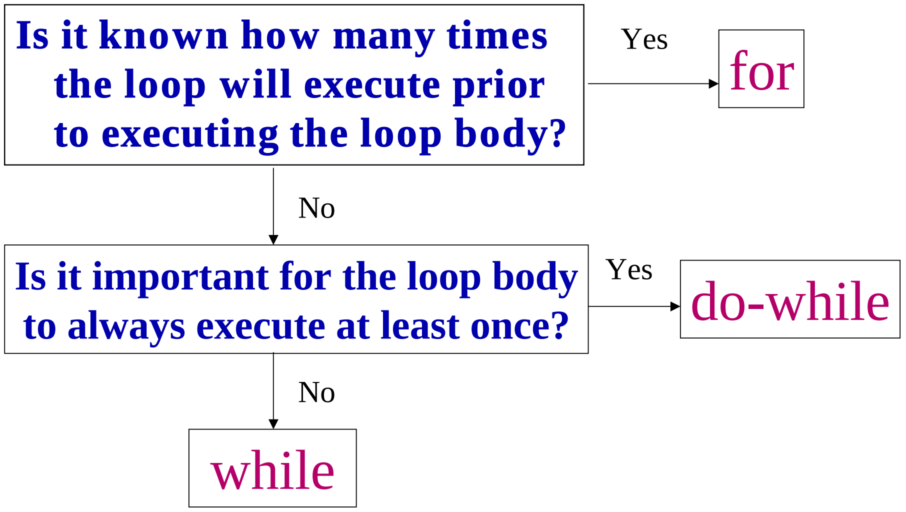
```
int i=0;
do
{
  System.out.println(i);
 i++;
}while(i<=10);
```

do-while Loop

```
int i=0;
do
{
  System.out.println(i);
 i++;
}while(i<=10);
```

Notice this semicolon was not here in the while loop!

When to use which loop?



Is it known how many times the loop will execute prior to executing the loop body?
Yes
for
No
Is it important for the loop body to always execute at least once?
Yes
do-while
No
while

When to use which loop?

Real answer:

Use which ever structure is most convenient, because all loop structures can be represented as any other loop structure.

Why are there multiple loop structures then?

Simple answer – for the programmer’s convenience.

Note: Java 5.0 offers another form of the `for` loop

We will cover this at a later point

Practice Problems

- **Write a loop to print out from 10 to 100 inclusive counting by 10s**
- **Write a loop that starts with an arbitrary double x and divides it by 2 repeatedly until it is less than 1. Output the number of times the loop executed. What is being computed?**
- **Write a loop that sums the first x integers where x is a positive integer. Print out the results.**
- **Write a loop that takes an integer x starting with value 1 and doubles x so long as x is positive. Bonus question: why doesn’t this loop infinitely? Super Bonus question: why does it loop infinitely when x is a double?**