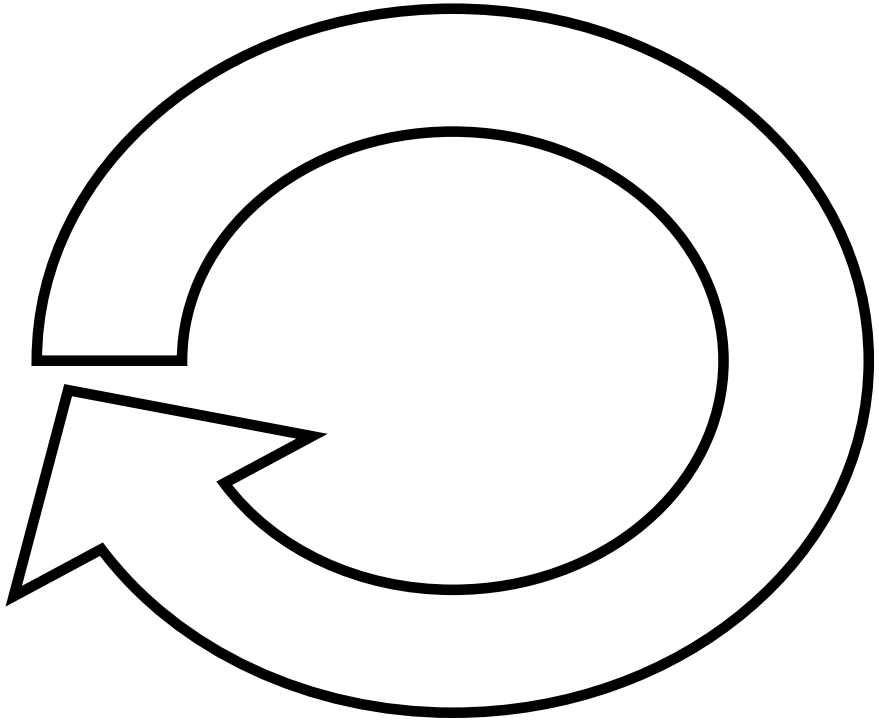
Looping Structures



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

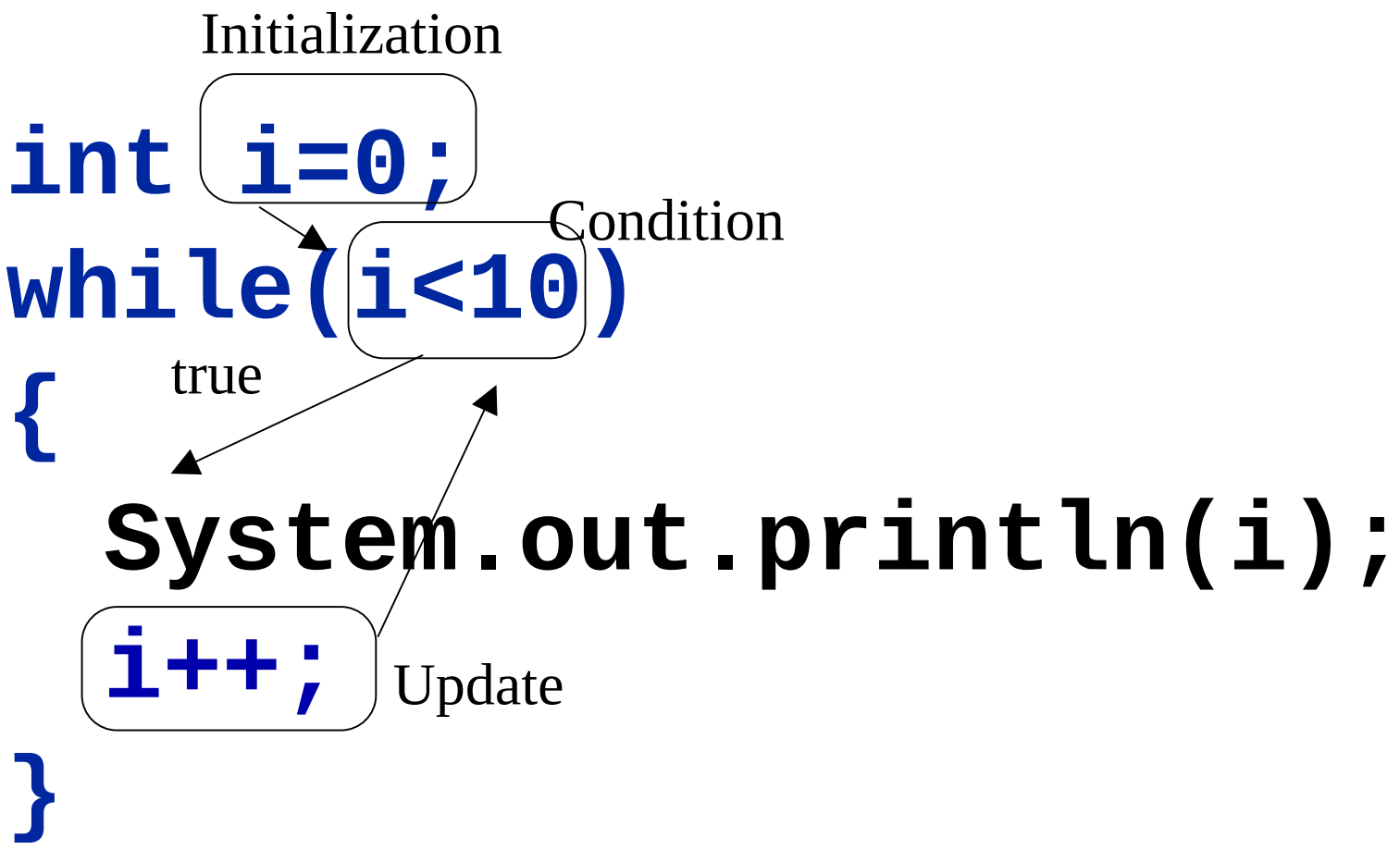
Okay, so that's not all. You also loop in order to:

- **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


Initialization
int i=0;
Condition
while(i<10)
{
true
System.out.println(i);
i++;
Update
}

while Loop

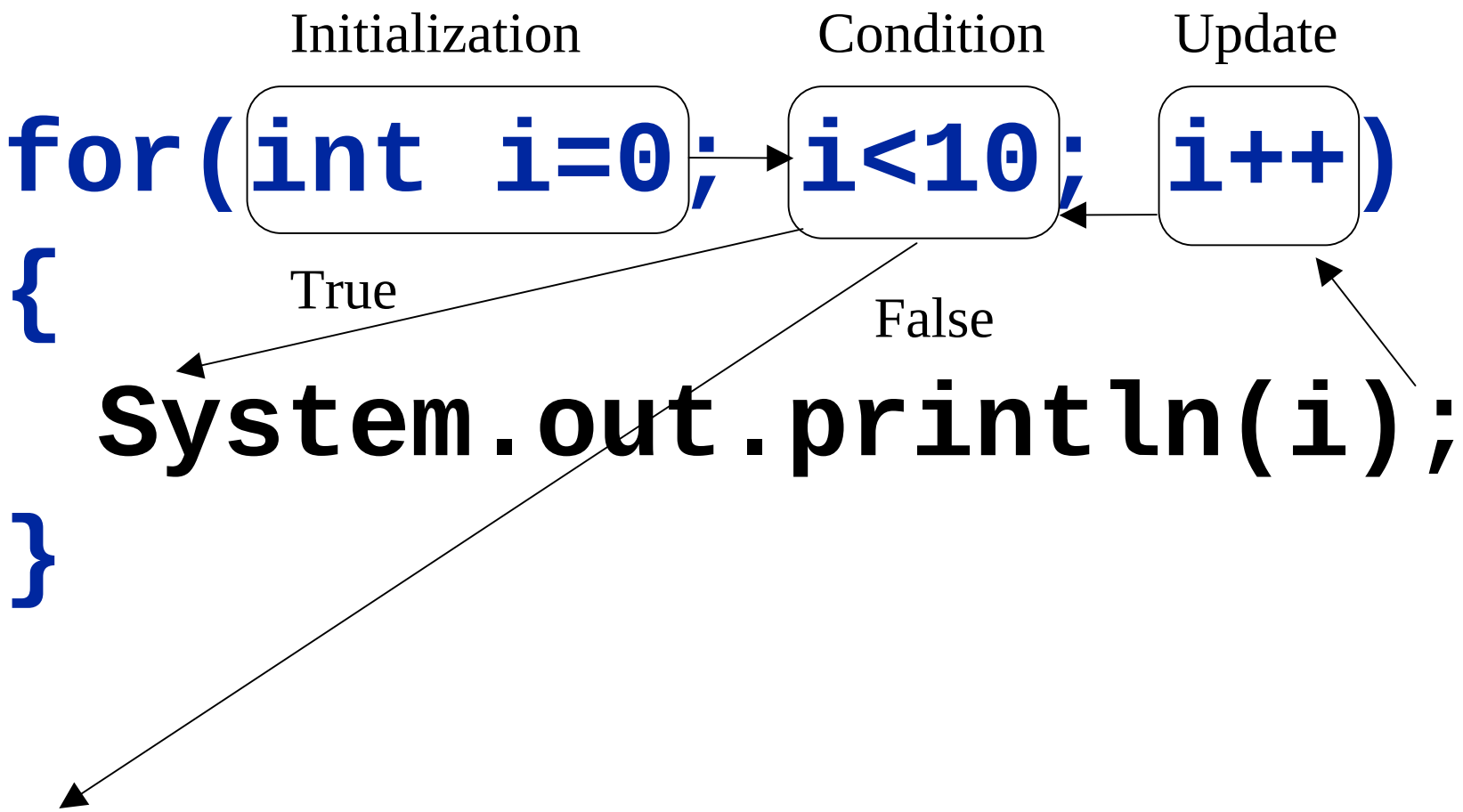
Why might this be a problem?

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

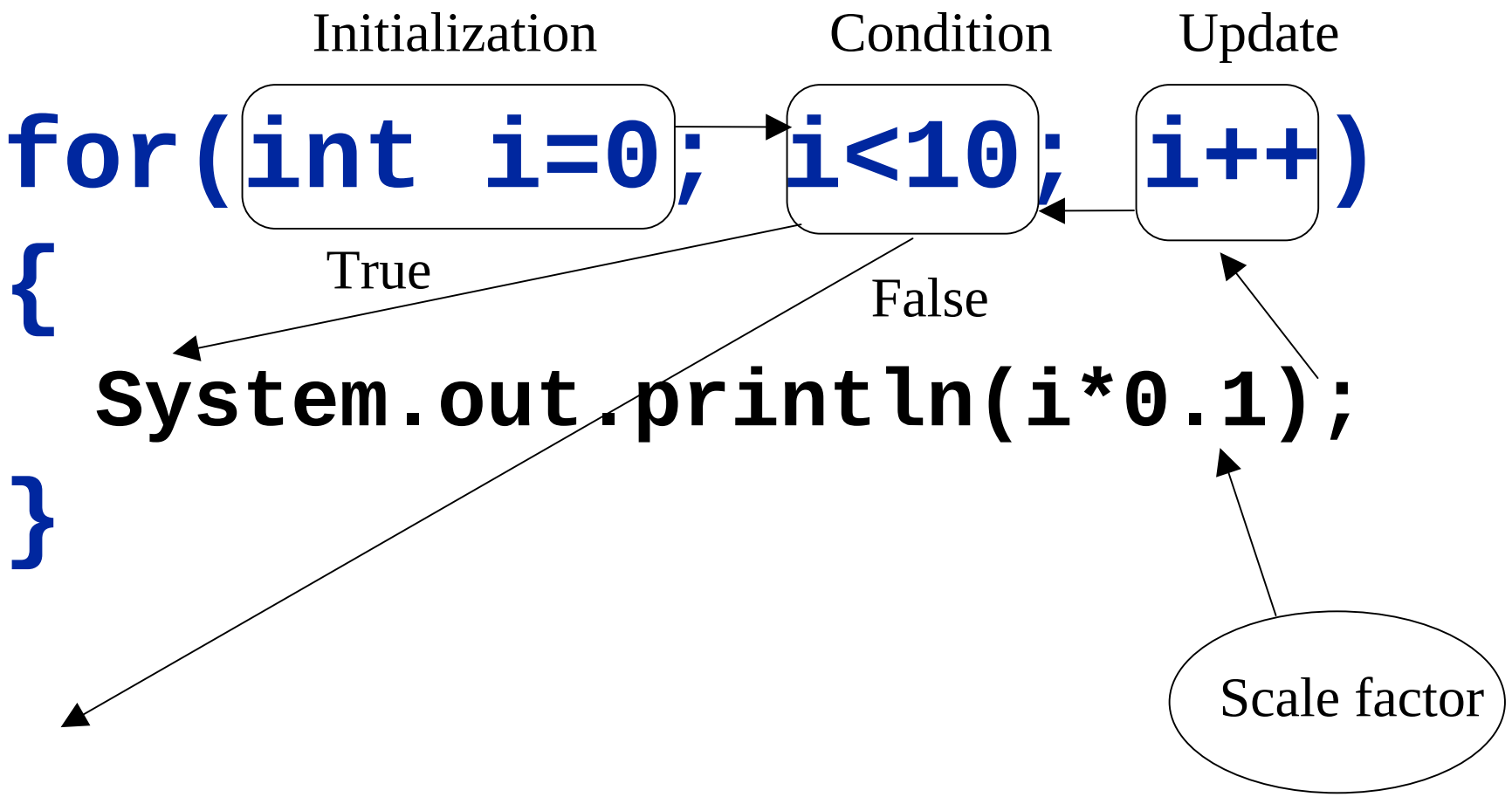
for Loop

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

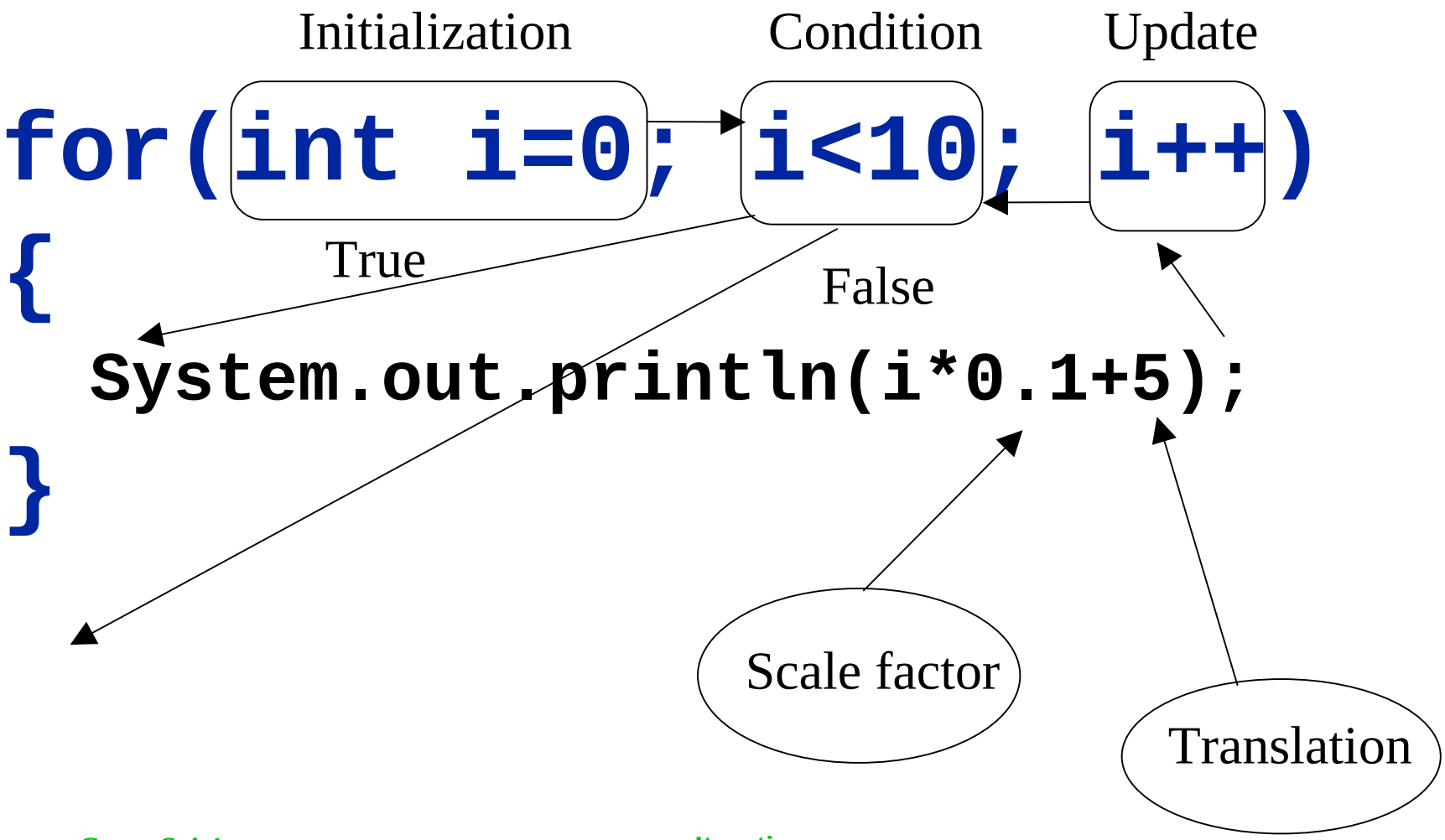
for Loop


Initialization
Condition
Update
for(int i=0; i<10; i++)
{
System.out.println(i);
}
True
False

for Loop


Initialization
Condition
Update
for(int i=0; i<10; i++)
{
System.out.println(i*0.1);
}
True
False
Scale factor

for Loop


Initialization
Condition
Update
for(int i=0; i<10; i++)
{
System.out.println(i*0.1+5);
}
True
False
Scale factor
Translation

Equivalence of Loops

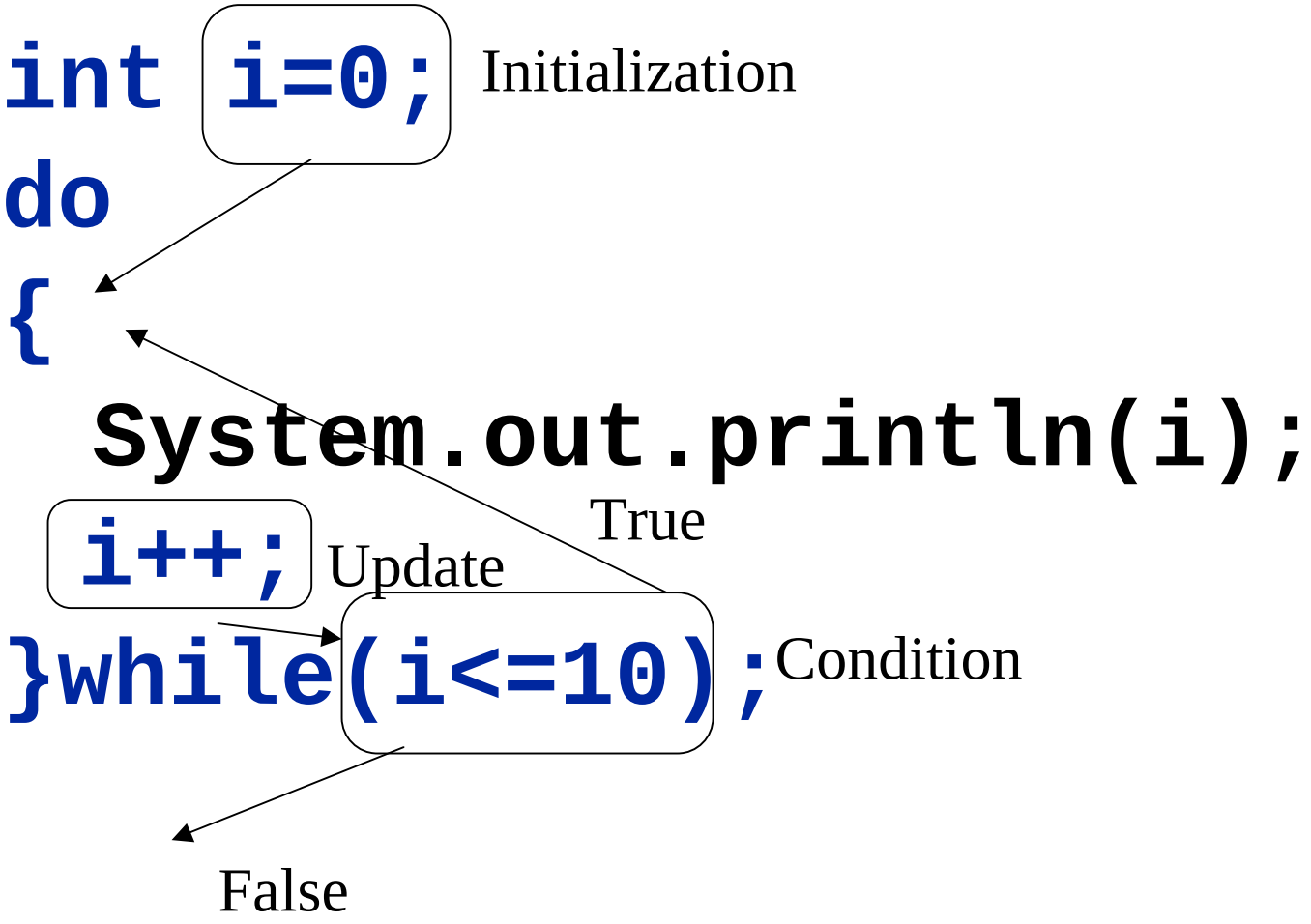
```
int i=0;
while(i<10)
{
  System.out.println(i);
  i++;
}
```

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

do-while Loop

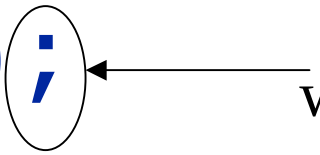
```
int i=0;
do
{
  System.out.println(i);
  i++;
}while(i<=10);
```

do-while Loop



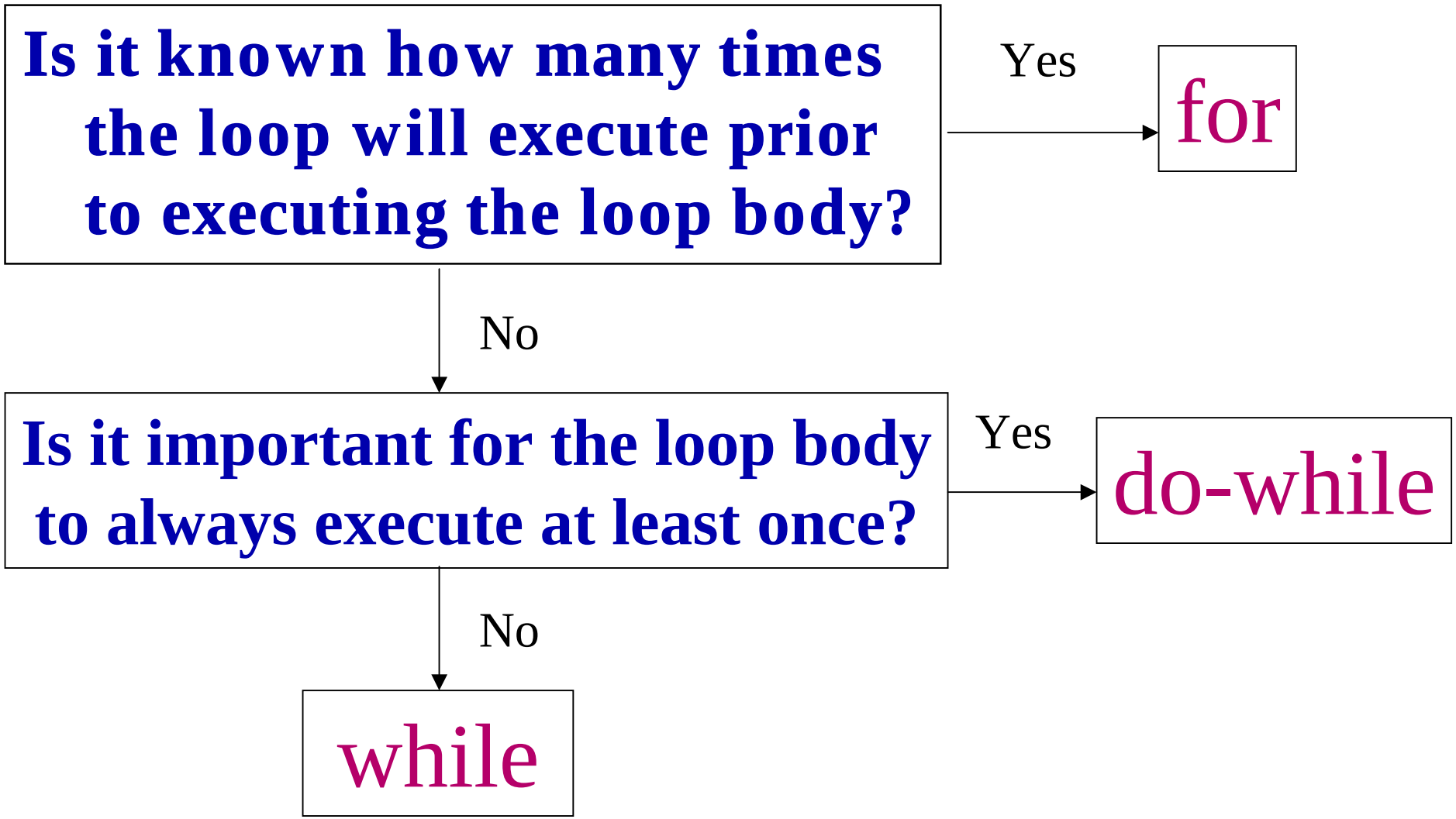
do-while Loop

```
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?



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?**