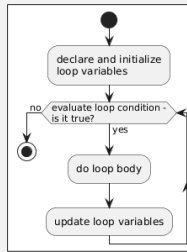


Loop Syntax and Semantics

- for loop


```
for ( declare and initialize loop variables ;
      loop condition ; update loop variables ) {
    loop body
}
```
- while loop


```
declare and initialize loop variables
while ( loop condition ) {
    loop body
    update loop variables
}
```
- semantics
 - declare and initialize loop variables
 - evaluate loop condition
 - if true, do the loop body, update loop variables, and evaluate the loop condition again
 - if false, exit the loop



Loop Questions → Loop Structure

- for loop


```
for ( declare and initialize loop variables ;
      loop condition ; update loop variables ) {
    loop body
}
```
- What is repeated? → loop body
- What changes from one repetition to the next → loop variable(s)
- How do things start? → initialization of loop variable(s)
- How do things change? → update of loop variables(s)
- When do you keep going? → loop condition
 - two patterns
 - repeat n times (counting loop)
 - repeat as long as / until – condition involves one or more of the “what changes” elements

Repeat As Long As (One Loop Variable)

- What is repeated? draw a red circle
- What changes from one repetition to the next? the y coordinate of the circle
- How do things start? at the bottom – (CENTER mode)
 $y = \text{height} - \text{radius of circle}$
- How do things change? y decreases – subtract the diameter of the circle
- When do you keep going? as long as the center of the circle is within the window – $y \geq 0$ (CENTER mode)

```

for ( (float) y = height-25; y >= 0; y = y-50 ) {
    fill(255, 0, 0);
    stroke(0);
    ellipse(width/2, y, 50, 50);
}
  
```

```

for ( declare and initialize loop variables ;
    loop condition ; update loop variables ) {
    loop body
}
  
```

Repeat As Long As (> 1 Loop Variable)

- What is repeated? draw a red circle
- What changes from one repetition to the next? the x and y coordinates of the circle
- How do things start? at the top – (CENTER mode)
 $x = \text{radius of circle}$
 $y = \text{radius of circle}$
- How do things change? x, y increase – add the diameter of the circle
- When do you keep going? as long as the whole circle fits within the window – (CENTER mode)
 $x + \text{radius} \leq \text{width}$
 $y + \text{radius} \leq \text{height}$

```

for ( (float) x = 25; y = 25; x+25 <= width && y+25 <= height; x = x+50, y = y+50 ) {
    fill(255, 0, 0);
    stroke(0);
    ellipse(x, y, 50, 50);
}
  
```

if the loop variables are the same type

```

for ( declare and initialize loop variables ;
    loop condition ; update loop variables ) {
    loop body
}
  
```

Repeat n Times – Counting Loops

- a *counting loop* is when the “keep going” condition involves a number of repetitions – repeat n times
 - introduce a *counter variable* to keep track of the number of repetitions completed so far

if the loop variables are all ints

```
for ( int count = 0,
      declare and initialize loop variables ;
      count < number of repetitions ;
      count = count+1, update loop variables ) {
    loop body
}
```

if the loop variables are not all ints

```
{
    declare and initialize loop variables
    for ( int count = 0 ;
          count < number of repetitions ;
          count = count+1, update loop variables ) {
        loop body
    }
}
```

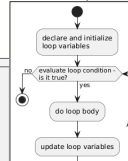
Counting Loops (int Loop Variables)

- What is repeated? draw a red circle
- What changes from one repetition to the next? the y coordinate of the circle
- How do things start? at the bottom – (CENTER mode) $y = \text{height} - \text{radius of circle}$
- How do things change? y decreases – subtract the diameter of the circle
- When do you keep going? repeat 4 times

```
for ( int count = 0, y = height-20; count < 4; count = count+1, y = y-40 ) {
    fill(255, 0, 0);
    stroke(0);
    ellipse(20, y, 40, 40);
}
```

if the loop variables are all ints

```
for ( int count = 0,
      declare and initialize loop variables ;
      count < number of repetitions ;
      count = count+1, update loop variables ) {
    loop body
}
```



Counting Loops (non-int Loop Variables)

- What is repeated? draw a red circle
- What changes from one repetition to the next? the y coordinate of the circle
- How do things start? at the bottom – (CENTER mode) $y = \text{height} - \text{radius of circle}$
- How do things change? y decreases – subtract the diameter of the circle
- When do you keep going? repeat 4 times

```
{
    float y = height-20;
    for ( int count = 0; count < 4; count = count+1, y = y-40 ) {
        fill(255, 0, 0);
        stroke(0);
        ellipse(20, y, 40, 40);
    }
}
```

if the loop variables are not all ints

```
{
    declare and initialize loop variables
    for ( int count = 0 ;
          count < number of repetitions ;
          count = count+1, update loop variables ) {
        loop body
    }
}
```

