

For Loops and Arrays

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Counting

```
int fireworkCount = 0;
while (fireworkCount < NUM_IN_FINALE) {
    new Firework (...);
    fireworkCount++;
}
```

Initialize counter

Test counter against limit

Repeating Task

Increment counter (update)

Counting with For Loops

```
for (int fireworkCount = 0;
     fireworkCount < NUM_IN_FINALE;
     fireworkCount++) {
    new Firework (...);
}
```

Initialize counter

Test counter against limit

Increment counter

Note:

- You can declare the counting variable (fireworkCount) before the for loop begins.

For Loops

```
for ( /* Initialization */;      /* Initialization */
     /* Test */;                while ( /* Test */ ) {
     /* Update */ ) {          /* Loop body */
     /* Loop body */          /* Update */
 }                             }
```

Initialization is done once - when the loop is first reached.
Test is done before each iteration, including the first
Update is done as if it were the last statement in the loop body
For loops are good when loop controls (initialization, test and update) all rely on the same variable, as in counting.

Nested Loops

```
double x;
double y;
public void onMouseClick (Location point) {
    // while there are more rows to knit
    for ( y = point.getY();
         y < point.getY() + SCARF_HEIGHT;
         y = y + Y_DISP ) {
        // knits one row
        for ( x = point.getX();
             x < point.getX() + SCARF_WIDTH;
             x = x + X_DISP ) {
            // knits one stitch
            new FramedOval(x, y, DIAMETER, DIAMETER, canvas);
        } // end of inner for
    } // end of outer for
}
```

Modifying a Digital Image

```
public void brighten (Picture pic) {
    for (int row = 0; row < imgHeight; row++) {
        for (int col = 0; col < imgWidth; col++) {
            Color originalColor = pic.getPixel(row, col);
            Color brighterColor = originalColor.brighter();
            pic.setPixel (row, col, brighterColor);
        }
    }
}
```

Hot Air Balloons

- Why can't we darken or lighten all the balloons when the mouse leaves the canvas and re-enters
- What would we need to do that?
- How can we grab different balloons and move them?

Arrays

Hold a collection of similar objects and allow access to individual objects

Declaring an array:

```
private HotAirBalloon[] balloonArray;
```

Constructing an array:

```
balloonArray = new HotAirBalloon [10];
```

Accessing an element in the array:

```
balloonArray[2]; (the third element in the array)
```

- Here 2 is the index of the array
- Array Indexing starts from 0

“Walking” an Array

```
public void onMouseExit (Location point) {  
    grass.setColor (DARK_GRASS);  
    sky.setColor (DARK_SKY);  
    for ( int i=0; i < balloonArray.length; i++ ) {  
        if (balloonArray[i] != null)  
            balloonArray[i].darker ();  
    }  
}
```

Notes:

balloonArray.length tells us how big the array is

arrays are indexed from 0 to its length - 1

for loops are commonly used to walk an array

Simpler Way to Walk Array

```
•private int nextBalloonIndex = 0;

•public void onMouseClick (Location point) {
    if (nextBalloonIndex < MAX_BALLOONS) {
        balloonArray[nextBalloonIndex] =
            new HotAirBalloon (point.getX (), point.getY (), canvas);
        nextBalloonIndex++;
    }
}

public void onMouseExit (Location point) {
    grass.setColor (DARK_GRASS);
    sky.setColor (DARK_SKY);
    for ( int i=0; i < nextBalloonIndex; i++ ) {
        balloonArray[i].darker ();
    }
}
```

Only call darker() on those elements of the array that have been instantiated (no need for null check)

Grabbing Other Balloons

```
•
// Figure out which balloon has been grabbed
public void onMousePress (Location point) {
    for (int i=0; i < nextBalloonIndex; i++) {
        if ( balloonArray[i].contains (point) ) {
            isAnyBalloonGrabbed = true;
            grabbedBalloonIndex = i;
            lastPoint = point;
            break;
        } // end if
    } // end for
} // end onMousePress

NextBalloonIndex keeps track of how many balloons have been
created so far.
ArrayIndexOutOfBoundsException if index < 0 or >= size of array
```

Moving the Grabbed Balloon

```
• // Move the grabbed hot air balloon
  // vertically where the mouse moves

• public void onMouseDrag (Location point) {
    if (isAnyBalloonGrabbed) {
        double dy = point.getY () - lastPoint.getY ();
        balloonArray[grabbedBalloonIndex].move (dy);
        lastPoint = point;
    }
}
```
