Nested Loops:

1. for (int i = 0; i < 10; i++)
   for (int j = 20; j >= 0; j--)
      System.out.println("hi");
   }

   "How many times is "hi" printed? 10 x 21 = 210

2. int i = 0
   while (i < 10)
      for (int j = i; j <= (i + 2); j++)
         System.out.println("i: "+" j");
         i++
   }

   Final i, j values?

<table>
<thead>
<tr>
<th>i</th>
<th>j</th>
<th>i+2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
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<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

(Infinite loop)
Arrays

array - list of values of the same type

ex: array of ints:

\[
\begin{array}{cccccc}
10 & 24 & 19 & 31 & 43 & 51 & 12
\end{array}
\]

Some terminology:

- length: \(7\)
- indices: \(0, 1, 2, 3, 4, 5, 6\)

indices go from 0 to length - 1 (6)

element: 24, 19, etc.

Creating an array:

ex: array of size 10 of ints

\[
\text{int } [\text{heights} ] = \text{new int}[10];
\]

can access length via heights.length \(\Rightarrow 10\)

This creates an empty array of size 10

\[
\begin{array}{ccccccc}
0 & 1 & 2 & 3 & 4 & 5 & 6
\end{array}
\]
To fill an array:

* Fill one index:
  heights[2] = 72

* Fill with variable for index:
  int x = 5;
  heights[x] = 61

Can access elements of array:

ex: int sum = heights[0] + heights[1]

Q: How to print the element in the middle?

System.out.println("middle element is: " + heights[heights.length/2])

Typically, we fill an array with a loop.
Q: What kind of loop? Usually a for loop since we know number of iterations.

exs:
int[] nums = new int[10]

(1) Fill nums with numbers from 0-9:
for (int i = 0; i < nums.length; i++)
  nums[i] = i
(2) Print the values:

```java
for (int i = 0; i < nums.length; i++)
    System.out.println(nums[i]);
```

(3) Program to input 10 ints from user and print in reverse

```java
Scanner scan = new Scanner(System.in);

int arr = new int[10];

// get input
for (int i = 0; i < 10; i++)
    System.out.println("Enter number");
    arr[i] = scan.nextInt();

// print in reverse
for (int i = length - 1; i >= 0; i--)
    System.out.println(arr[i]);
```

**Notice:** ok to have "int i" in both for loops since they each have scope local to their for loop
(2) How to modify previous program to get number of inputs from user?

// Before for loop:

```java
System.out.println("How many inputs? ");
int num = scan.nextInt();
int[] arr = new int[num];
```

(3) Get max of numbers in arr?

```java
int max = arr[0];
for (int i = 0; i < arr.length; i++)
    if (arr[i] > max)
        max = arr[i];
```

**Initializer List:** Set initial elements of array.

```java
int[] scores = {987, 98, 65, 43, 100};
char[] vowels = {'a', 'e', 'i', 'o', 'u'};
```

Arrays, like Strings, are objects and can cause exceptions (errors caused by objects).

```java
Sample code
```