Arrays

- An array is a collection of values of the same type stored consecutively in memory.
- `int arr[] = new int[5];`

  This declaration has 2 parts:

  the stuff on the right of the assignment

  the stuff on the left

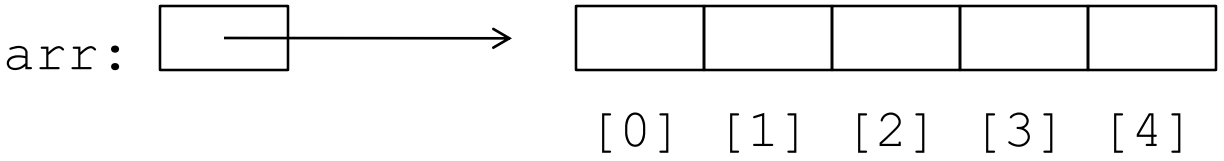
  Let's start with the part on the right

  keyword **new** has two properties

  1) allocates a chunk of memory big enough for 5 ints

  2) brings back the **address** of that chunk of memory(or throw Exception if out of memory)

- `int arr[] = new int[5];`
- Produces this:



- The **int arr[]** part creates a reference variable named arr. This ref variable contains the address of the first cell in the memory chunk. **arr** contains the **address** of the [0]'th cell. That why there is an arrow coming out of arr pointing at the [0] cell. Thus ***arr points to*** or **references** the beginning of the array

Array Terminology

- arr is the reference variable
- The chunk of memory is the object
- References point to objects.

- Putting values into the array is easy
- Use .length to determine how many cells the array has

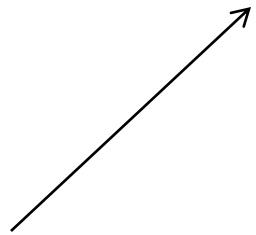
- for (int i=0 ; i<arr.length ; ++i)
  arr[i] = i*2;

now arr: [-]---> [0][2][4][6][8]

The .length property

- Once an array has been dimensioned you can always go back and ask the array how many cells of capacity it has.

- `int arr[] = new int[5];`
- `println( "arr has " + arr.length + " cells" );`



This expression produces the number 5

The array "discipline"

- There are certain rules to follow in order to use an array correctly. We refer to these rules as the ***array discipline.***

- Once you master these rules and become an advanced programmer you may find occasion to bend or violate them. In general however there are many good reasons for always following the rules.

The rules

- 1) When you declare an array you should declare an int named count or such to track how many values you have put into the array

- 2) initialize count to 0 and then use count to represent two things:
  - **the number of values** you have put into the array so far
  - **the index position** of where the next value should be stored

Passing Arrays

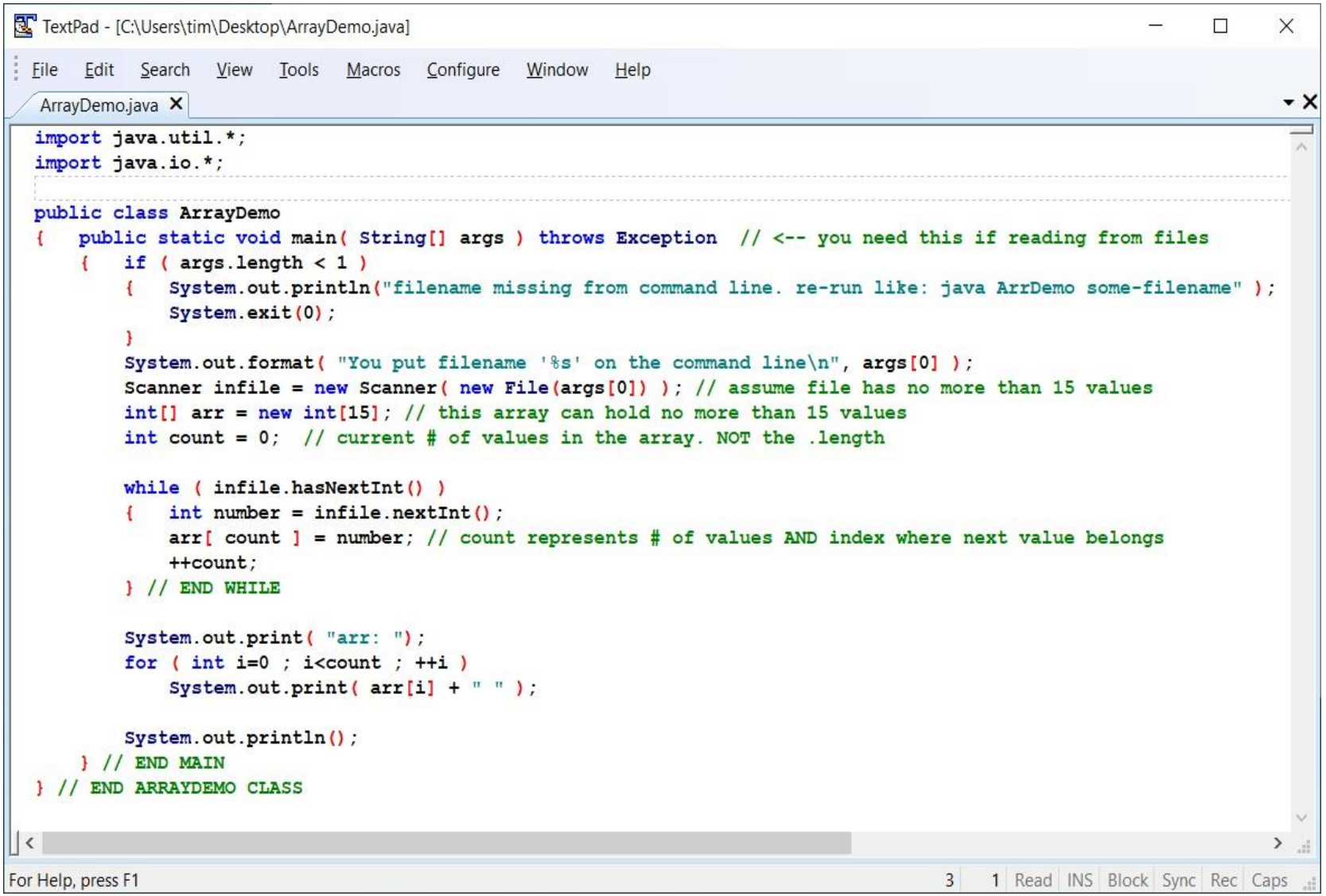
- **When you pass an array, you must pass it to a method that is written to receive and array.**

```
public static void main( String[] args )
{     int arrCnt = 0;
      int arr[] = new int[5]
      for (arrCnt=0 ; arrCnt<arr.length ; arrCnt++)
            arr[arrCnt] = arrCnt * 2;

      printArray( arr, arrCnt);
}
private static void printArray( int[] array, int cnt )
{
      for (int i=0 ; i < cnt ; ++i
            System.out.println( array[i] );

      System.out.println();
}
```

Passing Arrays II

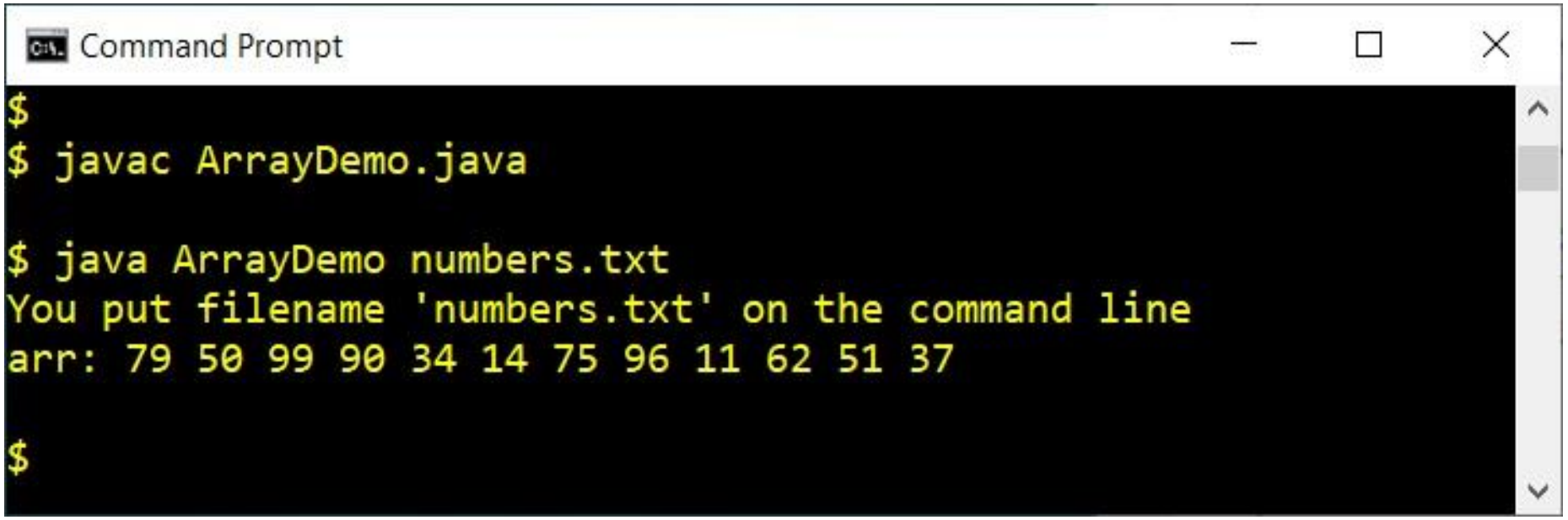
- When you pass an array you are just passing a copy of the address where the array starts. You are not passing a copy of the data values.
- It would be very memory inefficient to make a copy of the actual array and send that to the method.
- It is much more efficient to just pass a copy of the address (reference)

Filling an Array from a file



numbers.txt contains: 79 50 99 90 34 14 75 96 11 62 51 37

This is what the execution looks like



Watch how we gradually refine the loop that reads the numbers into the array

```
while ( infile.hasNextInt() )
{  int number = infile.nextInt();
   arr[ count++ ] = number;
} // END WHILE
```

- Notice we increment the count inside the []s

And now another refinement of the loop

```
while ( infile.hasNextInt() )
{  int number = infile.nextInt();
   arr[count++] = infile.nextInt();
} // END WHILE
```

- There was no need to read the number into a variable. We can read it directly into the array