Arrays – 2D

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Announcements

TODO Reminders:

Readings are due **before** lecture

- Reading 27 (zybooks) – you should have already done that ☺
- Lab 18
- Reading 28 (zyBooks)
- Lab 19
- Practical Project Part 2
- RPA 14

Keep practicing your RPAs in a spaced and mixed manner ☺

Help Desk

Day	**Time : Room**
Monday	12 PM - 2 PM : CSB 120
Tuesday	6 PM - 8 PM : Teams
Wednesday	3 PM - 5 PM : CSB 120
Thursday	6 PM - 8 PM : Teams
Friday	3 PM - 5 PM : CSB 120
Saturday	12 PM - 4 PM : Teams
Sunday	12 PM - 4 PM : Teams

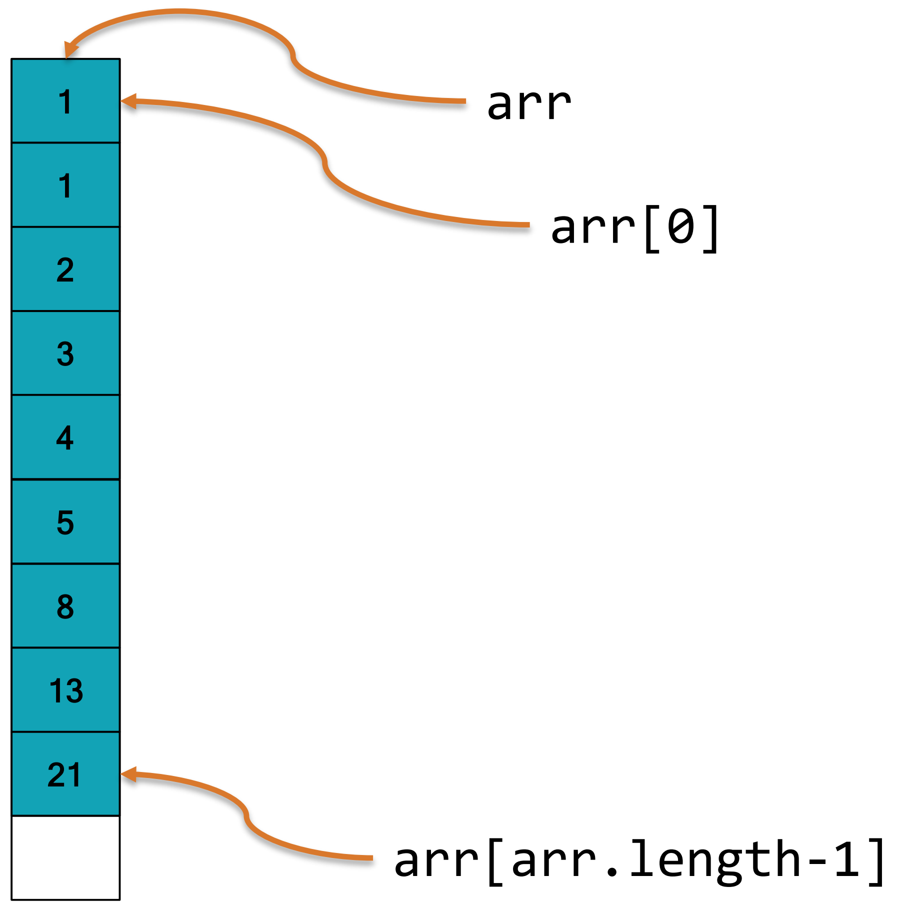
Arrays – Recall and Group Code Activity

- Brainstorm in your group and write what you all can remember about arrays.

Arrays - Reminder

- Ways to store
  - Variables in order
  - index from 0..N
- Arrays are
  - a type themselves
  - the value of the array
    - reference to memory location!
  - .length gives us total memory allocated
- Arrays can
  - be any size – as long as you allocate it
  - Store any <u>valid</u> type
    - primitives and objects

```
int[] arr = {1,1,2,3,5,8,13,21};
```



Loops are common ways to access elements!

Arrays – easy access with For-Each

- For-Each Loops
  - Specialized for loops
  - Perfect for arrays or other collections
- Loops through every value (0..N)
  - Stores it in a temp variable
- Same as some very common for loops!

```
public static String[] foreachExample() {
    String[] values = new String[2]; // string array!
    values[0] = "Fib:";
    values[1] = "Fib:";
    int[] arr = {1,1,2,3,5,8,13,21};

    for(int i =0; i<arr.length; i++) {
        int ar = arr[i];
        values[0] += ar;
    }

    for(int ar : arr) {
        values[1] += ar;
    }
    return values;
}
```

Equivalent!

```
[Fib:1123581321, Fib:1123581321]
```

Arrays with objects?

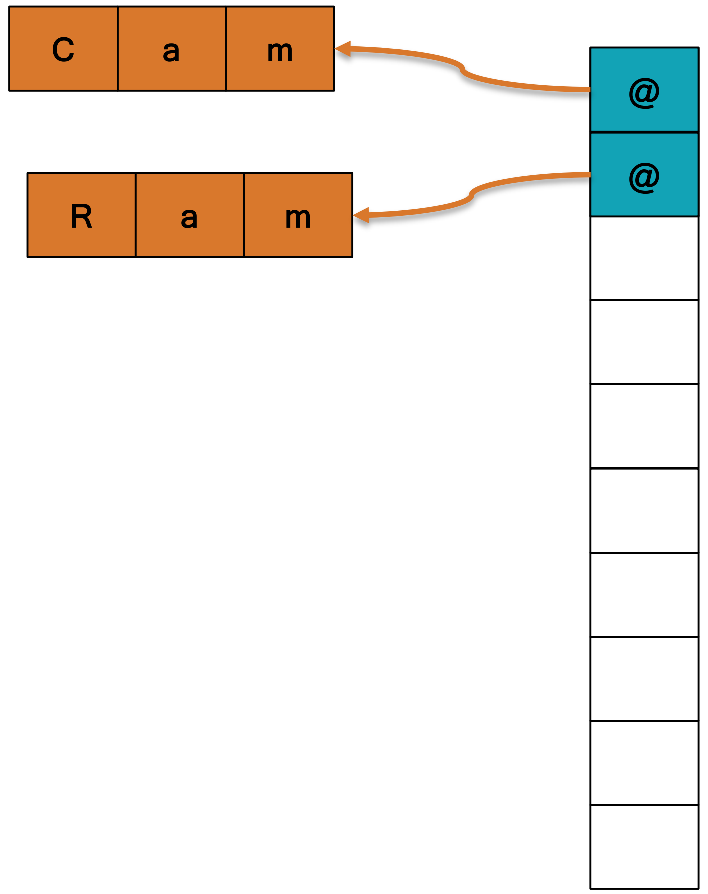
- primitives – values are stored
- objects – references to values

```
Box[] values = new Box[10];

MyObject[] values = new MyObject[5];
```

- Can you have an arrays of arrays?
- Arrays have type
  - Anything with type can be an array!

```
String[] values = new String[2];
```



```
values[0] = “Cam”;
values[1] = “Ram”;
```

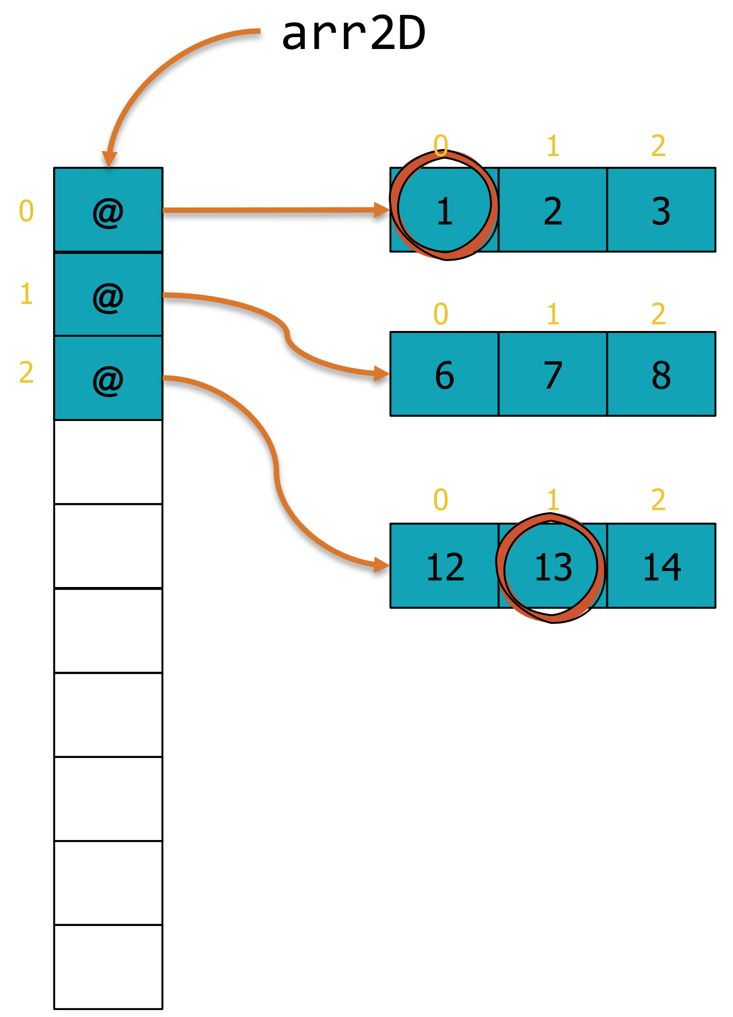
2D Arrays!

- 2D arrays
  - Array of arrays
  - Same type
- very common
  - enough we have a shorthand notation

```
int[][] arr2D = {{1,2,3},{6,7,8},{12,13,14}};

System.out.println(arr2D[0][0]);

System.out.println(arr2D[2][1]);
```



2D Arrays - Declaring

int matrix [][] = new int[3][3];

print2D(matrix);

```
0   0   0
0   0   0
0   0   0
```

```
public static void print2D(int [][] matrix) {

    for(int[] row : matrix) {
        for(int col : row) {
            System.out.printf("%4d", col);
        }
        System.out.println();
    }
}
```

2D Arrays – Irregular/Ragged Arrays

- You can have arrays of variable length within an array
- Those are called “irregular or ragged” arrays

```
int ragged [][] = new int[3][];

System.out.println(Arrays.toString(ragged));

print2D(ragged);
```

```
[null, null, null]
```

```
int ragged2 [][] = new int[3][];

irregular(ragged2);

print2D(ragged2);
```

```
  0   1   2   3
 10  11  12  13  14  15
 20  21
```

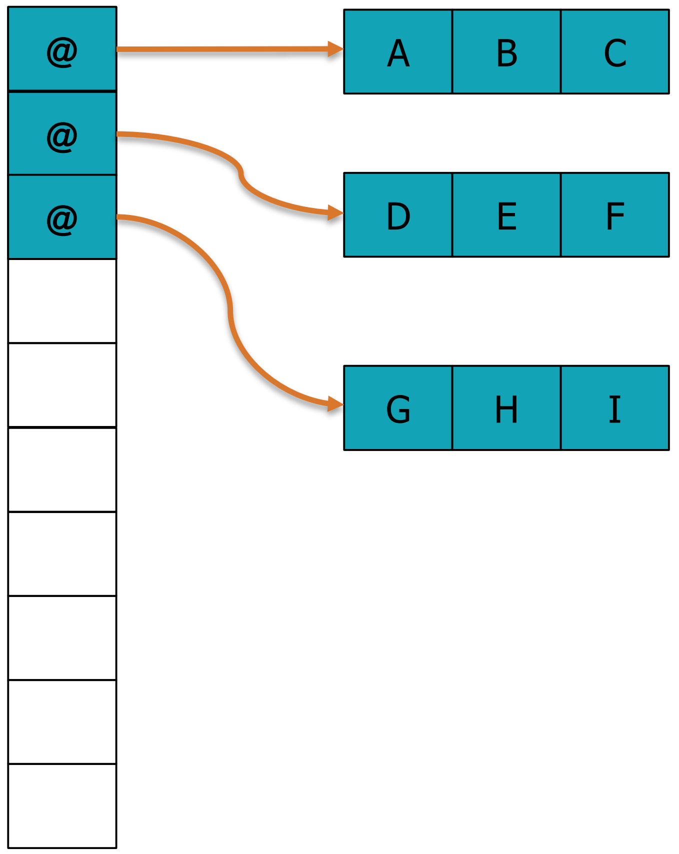
```
public static void print2D(int [][] matrix) {

    for(int[] row : matrix) {
        for(int col : row) {
            System.out.printf(“%4d”, col);
        }
      System.out.println();
    }
}

public static void irregular(int [][] ragged) {
    Random rnd = new Random();
    for(int i = 0; i < ragged.length; i++) {
        ragged[i] = new int[rnd.nextInt(6)+1];
        for(int j = 0; j < ragged[i].length; j++) {
            ragged[i][j] = j + (i *10);
        }
    }
}
```

2D Arrays – Common With Nested Loops

```
public static void twoDArrays(int size) {
    char[][] matrix = new char[size][size];
    char start = 'A';
    for(int i = 0; i < size; i++) {
        for(int j = 0; j < size; j++) {
            matrix[i][j] += (char) (start+j);
        }
        start = (char)(matrix[i][size-1]+1);
    }
    for(char[] row : matrix) {
        for(char col : row) {
            System.out.printf("%4d", col);
        }
        System.out.println();
    }
}
public static void main(String[] args) {
    twoDArrays(3);
}
```



2D Arrays –Group Code Activity

- Write a Array2DInt class that:
- builds an array of 2D of int of a specific size;
- add user entered values to that 2D array;
- builds a toString method that return a String with the 2D array as a matrix format.

Challenge: what do you need to do to be able to read the numbers from a file instead of reading from the console?

```
public static void twoDArrays(int size) {
    char[][] matrix = new char[size][size];
    char start = 'A';
    for(int i = 0; i < size; i++) {
        for(int j = 0; j < size; j++) {
            matrix[i][j] += (char) (start+j);
        }
        start = (char)(matrix[i][size-1]+1);
    }
    for(char[] row : matrix) {
        for(char col : row) {
            System.out.print(col);
        }
    }
}
```

```
public static void main(String[] args) {
     twoDArrays(3);
}
```