

Lecture Set #15: Two-Dimensional Arrays

1. 2-dimensional arrays
 1. Ragged Arrays
 2. Rectangular Arrays



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Jan Plane (adapted from Bonnie Dorr)

Recall Arrays

- Arrays: sequences of elements from the same base type

```
int[] a;      // array of ints
Date[] d;     // array of references to Dates
```
- Base type may be:
 - Primitive (i.e. int)
 - Reference (i.e. Date, other objects)
- **Arrays are also objects.**
- **Notice the similarities:**
 - Arrays created using `new`
 - Array elements stored on heap
 - Array variables store references to space on the heap

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Allocation of Space

- Syntax for allocating space for the 1st level array:

```
char[][] a;      // Array of char arrays
a = new char[3][]; // Create array of 3 arrays
```
- Syntax for allocating space for the 2nd level of arrays:

```
a[0] = new char[4]; // Create array of 4 char
a[1] = new char[6]; // Create array of 6 char
a[2] = new char[3]; // Create array of 3 char
```

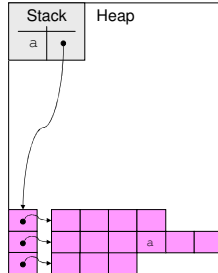
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Example

```
char[][] a;  
a = new char[3][];  
a[0] = new char[4];  
a[1] = new char[6];  
a[2] = new char[3];  
a[1][3] = 'a';
```

- This array has **two dimensions**: rows, columns
- This kind of array is called **ragged** because the rows are of unequal length



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Questions

```
char[][] a;  
a = new char[3][];  
a[0] = new char[4];  
a[1] = new char[6];  
a[2] = new char[3];  
• What does a[1][2] = 'x'; do?  
  Set element in row 2, column 3 to 'x'  
• What does a.length return?  
  3  
• What does a[1].length return?  
  6  
What type is a?  
  a reference to an array of array references  
What Type is a[0]?  
  a reference to an array of characters  
What type is a[0][0]?  
  a character
```

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Initializers

• In one dimension:

```
char[][] a;  
a = new char[3][];  
a[0] = {'a', 'b', 'c', 'd'};  
a[1] = {'x', 'y', 'z'};  
a[2] = {'m', 'n'};
```

• In two dimensions:

```
char[][] a = {{ 'a', 'b', 'c', 'd' },  
              { 'x', 'y', 'z' },  
              { 'm', 'n' } };
```

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Rectangular Arrays



- Often we want 2-dimensional arrays in which rows have the same length
 - Tables
 - Matrices
- Java has a special short-hand syntax for creating rectangular arrays

```
int[][] a = new int[2][4]; // 2 rows, 4 cols
```

Equivalent to:

```
int[][] a = new int[2][];  
a[0] = new int[4];  
a[1] = new int[4];
```

- The short-hand takes care of allocating each row, initializing each cell in each row

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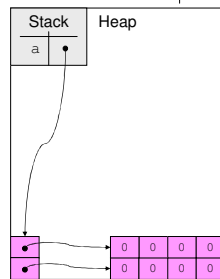
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Example



```
int[][] a = new int[2][4];
```

- Note each cell is initialized to default value (0)
- Each row is a 1-dim array



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2-D Arrays of Objects Also Possible



- Of Strings:

```
String[][] s = new String[4][2];
```

```
s[0][0] = "Fred";
```

```
s[1][1] = "Jane";
```

- Of Cats:

```
Cat[][] c = new Cat[4][2];
```

```
c[0][0] = new Cat("Fred");
```

```
c[1][1] = new Cat("Jane");
```

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