RADFORD UNIVERSITY

ITEC 120

Lecture 21
Expanding on 2D Arrays

Review

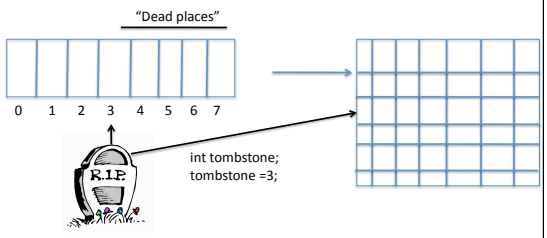
- 2D Arrays
  - Creation
  - Walking
  - Sum/min/max
  - Copying
  - Game of life

Objectives

- Revisit
  - Tombstones
  - Swapping
  - Insertion
  - Marking
  - Parallel Arrays

Tombstones

- Expanded to handle rows / columns



Before / After

- Only have to worry about one variable
- Need two variables
  - Update to handle rows / columns

```
int tombr=0;
int tombc=0;
if (tombr < array.length)
    array[tombr][tombc] = value;
if (tombc+1 == array[tombr].length)
{
    tombr++;
    tombc=0;
}
else
    tombc++;
```


Capacity

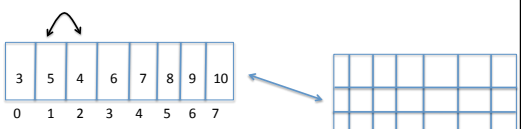
- Do you fill left to right?
- Do you fill from top to bottom?
- Code changes with each decision.
- Adding an extra degree of freedom exponentially increases the cost of creating similar utilities.

Issue

- No way to use a function to completely manage a 2D array using the tombstone concept without creativity
  - Can only return 1 value
- Shortcut
  - Return tombx,tomby as a string
  - Have tombstone function handle the string
- Example

Swapping

- Replace one value w/ another and vice versa



- Code

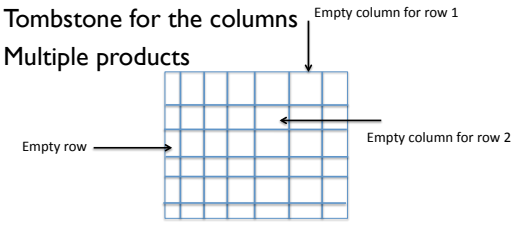
```
int temp = array[r1][c1];
array[r1][c1] = array[r2][c2];
array[r2][c2] = temp;
```

2D Array insertion

- Code example
  - Take a value and x,y position
  - Shift values to the right and down
  - Toss out last value in array

New possibilities

- Tombstone for the rows
- Tombstone for the columns
- Multiple products



Code

```
int[][] array = new int[5][5];
int freeR=0;
int[] freeC = new int[array[0].length];
array[0][freeC[0]] = 3;
freeC[0]++;
```

Issues:
How do you decide what row to work on?
What happens when 1 row fills up?

Sorting

- There is no one right answer
  - Sort each column individually
  - Sort each row individually
  - Is there any association between row / column values?
  - Algorithm stays the same
    - Find the smallest
    - Move to beginning
    - Repeat until happy

Parallel Arrays

- Storing multiple related values together
- One array can't do it
- Many arrays can

First name	Last name	Account Balance
John	Doe	300.00
Alpha	Bet	26.00
El	ite	1337.00

Obvious

- 2D Arrays are parallel arrays
  - Of one type
- Can use multiple 2D arrays together
- Archeological dig scenario

```
int[][] weightOfArtifacts = new int[20][20];
String[][] locationName = new String[20][20];
```

Grow/Shrink

- Once again, instead of just one choice, you now have 2 choices to worry about
- Growing
  - Rows / Columns
- Shrinking
  - Rows / Columns
- Copying and not walking off the end of the array

Complexity

- Tools versus application distinction
- Setting up a 2D array to be used can be as difficult to do as a regular homework assignment
- Add on top its usage and…

Considerations

- Are row / column relationships important?
- Adjust capabilities as to relationships
- Know your data
- See previous point
- Write functions to do the work first
- Test
- Then use them on a project

Summary

- 2D arrays can be hard to handle
- Determine how they have to be used
- Write functions
- Test
- Use in your project