Ch7: Arrays

31 January 2007
CMPT167
Dr. Sean Ho
Trinity Western University

TRINITY WESTERN UNIVERSITY

Review of last time

- More on applets; running applets
- While loops
- Do/while loops
- For loops as while loops
- Switch/case statement
- Labeled blocks

Arrays in Java

- Aggregate (compound/container) data type
  - All entries have same type
  - Size of array is fixed when array is allocated
    - But need not be known at compile-time
    - Arrays can be dynamically created
  - Location in memory is usually contiguous
  - Index into array using integer indices from 0 up to (size of array)-1
    - Indexing out-of-bounds raises ArrayIndexOutOfBoundsException

Working with arrays

- Declaring arrays:
  - int numApples[];
- Allocate array in memory:
  - numApples = new int[10];
- Initializing array entries:
  - numApples[3] = 15;
- Size of array:
  - numApples.length // returns 10

Array initializers and constants

- Initialize an array on one line:
  - int numApples[] = {5, 3, 12, 0, 3};
- Declare constants using the keyword final:
  - final int numApples[] = {5, 3, 12, 0, 3};
  - final float pi = 3.14159265358979323846264;
- (Histogram.java example)

Pass-by-value vs. pass-by-reference

- In Java, primitives (int, float, boolean, etc.) are passed by value
- Objects (including arrays) are passed by reference

Multidimensional arrays

- The element type of an array can be any type, including objects, including other arrays:

```
int image[][];
image = new int[width][height];
for (int x=0; x<width; x++)
    for (int y=0; y<width; y++)
        image[x][y] += 10;
```

- Rows may be different lengths:

```
image = new int[width][];
for (int x=0; x<width; x++)
    image[x] = new int[x];      // triangular array
```

Iterating through arrays

- Iterate through an array with a for loop:

```
for (int idx=0; idx < array.length; idx++)
    sum += array[idx];
```

- Java has an enhancement to the for loop:

```
for (int elt : array)
    sum += elt;
```

- But note elt is a copy of each element:
  - Can't use this to modify array

Sorting arrays: bubble sort

- Bubble sort: most straightforward sort algorithm
  - Smaller values "bubble" to start of array
  - Larger values "sink" to end of array
  - Use nested loops to make several passes through array
  - Each pass compares successive pairs of elements:
    - Pairs are swapped if in decreasing order

Sorting arrays: selection sort

- Bubble sort is not so fast but is easy to write
- Selection sort is a little faster and almost as easy:
  - Iterate through the list:
    - Find smallest value in the remainder of the list
    - Swap with current element

- Lots of other, better algorithms for sorting:
  - See CMPT231 and demos @UBC

TODO

- Lab1b due tonight:
  - Repetition structure
- Lab2 due next Wed 7Feb:
  - Arrays (magic square)
  - Preferably not a command-line program
  - Applet or stand-alone GUI program
  - AWT or Swing