

Arrays

Dr. Jey Veerasamy

jeyv@utdallas.edu

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9:30 am to 12 noon

More Activities/Examples

- Use a box to move lots of things from one room to another
- Holiday shopping list 😊
- A lengthy to-do list 😞
- A list of all the students in the class
- Itemized grocery store bill 😊

What is the common thing here?

More Activities/Examples

- Use a box to move lots of things from one room to another
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What is the common thing here?

Collection / List / Arrays

Arrays in Programming

- enable us to store data of similar type together.
- enables us to handle lists of varying size.
- Lines of code do not increase with more data!
- Access array's items using index.

Array definition in Java

Initializing with data directly:

```
int numbers[] = {10, 15, 30, 20, 25, 8};
```

Dynamic allocation:

```
int numbers[] = new int [30];
```

Problem:

Searching in unsorted array

- Unsorted array: { 7, 11, 5, 4, 20, 13, 2}
- Search in a sequence
 - Stop if the search item is found
 - Need to search all the way if item is not found
- Code: Array1.java

Problem:

Searching in sorted array

{ 2, 4, 5, 7, 11, 13, 20 }

- Smart thing is to start with the middle # & decide which side we need to go.
- Similar to guessing game.
- With every check, target array size becomes half.
- Array2.java – does binary search
- Array2v2.java – uses additional method
- Array2v3.java – reads the array data from a file – right-click on the project and add New ... Empty file ... name it as input.txt (see the sample file contents under code directory in the web).

Searching in large sorted array

- Similar to searching for patient's record in Doctor office (or) searching for a number in telephone book

Problem:

Finding min/max/average of array

- Unsorted array: need to search through the whole array for Min/Max.
- Sorted array: first item is the Min, last item is the Max.
- No difference in finding average in sorted and unsorted arrays.

Problem: Country Store Version 4

Re-do using arrays

Problem: Country Store Version 5

Use a new method for check-out.

Just like a regular store, allow the program to check-out several customers (one after another), before associate decides to close.

Problem:

Find 2 closest numbers in a list

- Sorted vs. unsorted list

Problem: Thief visits a Doctor 😊

- Doctor asks a few questions:
 - Is there a lot of stress on the job?
 - Do you carry heavy weight?

Problem: Thief visits a Doctor 😊

- Doctor asks a few questions:
 - Is there a lot of stress on the job?
 - Do you carry heavy weight?
- Doctor says: Never carry > 50 pounds

Thief version 1

- Thief is allowed to take only one item.
- Item weights: 40, 10, 46, 23, 22, 16, 27, 6
- Instance #1: Target : 50
- Instance #2: Target: 60
- Instance #3: Target: 70

Thief version 2

- Thief is allowed to take only 2 items.
- Item weights: 40, 10, 46, 23, 22, 16, 27, 6
- Instance #1: Target : 50
- Instance #2: Target: 60
- Instance #3: Target: 70

Thief version 3 ???

- Thief can carry any # of items.
- Item weights: 40, 10, 46, 23, 22, 16, 27, 6
- Instance #1: Target : 50
- Instance #2: Target: 60
- Instance #3: Target: 70

Problem: version of Hangman game

```
(Guess) Enter a letter in word ***** > p
(Guess) Enter a letter in word p***** > r
(Guess) Enter a letter in word pr**r** > p
      p is already in the word
(Guess) Enter a letter in word pr**r** > o
(Guess) Enter a letter in word pro*r** > g
(Guess) Enter a letter in word progr** > n
      n is not in the word
(Guess) Enter a letter in word progr** > m
(Guess) Enter a letter in word progr*m > a
The word is program. You missed 1 time
```

Methods

- main() is default method that every Java program needs to have. Additional methods are used to manage software complexity and to enable code reuse.
- each method can
 - take a list of parameters
 - return value

Grocery Store Version 1

- Country store has been expanded significantly & it sells 100s of products now. Instead of identifying each product by its name, program should use PLU code going forward.
- We will read the product information from a data file products.txt, before prompting the associate for checkout operations.
- Associate should be able to checkout several customers until the store closes.

Grocery Store Version 2

- Assuming we have 1000's of products, how to improve the search?

Problem: Find winner of tic-tac-toe

Problem: Verify Sudoku answer

Problem: brute-force word search

Create a word-search puzzle using the following site
<http://puzzlemaker.discoveryeducation.com/WordSearchSetupForm.asp>

Keep it simple by using the default 15x15 size. Click on Text in Step 4. Store the output in a file called "wordsearch_data.txt". Then, your program should read the puzzle contents followed by the words from that file. Sample data file is attached. Your program should output only the cells that correspond to letters of actual search words. You can output blank space for all other cells.

Word search: sample input file

M J N W B X H S J P L W P I J
U T G U I A C L A E Z E D F B
J J K Z J J L Y T X E T M D W
F U N C T I O N A L P Z L V W
T G S C R U M A J O V H A G L
A J Z I E S U U I S Q Z N A I
Z N A T W Q Z L D H Z L D W Q
E H A H B I H K I O U Y E J G
D Z H G T J L J Q B G F R Z Q
U E A E K Y B L F I E H T D S
X V M G V W Y F I X C U L D J
F S D G F X Z L C N M R G L M
D P F Z R N K U T G G D S U S
K G I T M P S O L L T G A Z N
W R U B T E W T R T V R Z U A

EXCUSE

FUNCTIONAL

GOD

LANDER

TEXT

WILLING

Word search: sample output

T X E T

F U N C T I O N A L L

A

N

W D D

I O E

L G R

L E

I X

C N

U G

S

E

Expanding array dynamically

- When we don't know how many input items are going to be there, we have to go with a starting size, then expand when needed.
- There is a better more-sophisticated approach: ArrayList

For more details

- Java arrays: official tutorial

<http://docs.oracle.com/javase/tutorial/java/nutsandbolts/arrays.html>