

CSI 32 LECTURE NOTES (Ojakian)

Topic 10: Arrays and Memory

OUTLINE

PRIMER: 4.1

TRANSITION GUIDE: 8.5

1. Array basics
 2. Memory issues
 3. Compiled language versus Interpreted Language
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1. Idea of Arrays

- (a) Used as an underlying data structure in Python and C++
- (b) Array (one useful definition): A collection of objects of the same size stored in a contiguous manner in the memory of the computer.
- (c) Do example with addresses of array of ints, and then array of short ints.

2. Declaration of Arrays

NOTE: In general, I would NOT recommend using arrays directly!

- (a) Fixed size, must be chosen when initialized.
- (b) Try for-loops through array
- (c) Consider operation outside its range

3. Array Copy

- (a) Can not just assign, as done in Python.
- (b) Arrays automatically passed to functions BY REFERENCE.

PROBLEM 1. Write a function that copies the contents of one array to another array.

4. C++ Pointers and Arrays and Moving Around

- (a) The array name corresponds to the address of its first element (also called: “foundation address”, or “base address”)
- (b) Can add and subtract with pointer to get a new pointer to new location.
- (c) Can point “one past the end” (don’t dereference!) but no further

PROBLEM 2. See the example program.

5. More Behind The Scenes on Arrays

PROBLEM 3. Suppose a C++ array of integers has a first address of 2000 (in decimal). Suppose there are 50 items in the array. Answer the following questions:

- (a) *How many bytes of memory are used by the array?*
- (b) *What is the address of the first item in the array?*
- (c) *What is the address of the following items in the array:
2nd item, 20th item, last item?*
- (d) *The second item occupies which bytes in the memory?*
- (e) *If a new item is added to the end of the array, which bytes of memory will it occupy?
(this has a reasonable answer and a ... more reasonable answer)*

(a) Random Access:

- i. Random Access (from Wikipedia): *“is the ability to access an arbitrary element of a sequence in equal time or any datum from a population of addressable elements roughly as easily and efficiently as any other, no matter how many elements may be in the set.”*
- ii. Distinguish finding the item at index k in the array via linear search versus random access (considering last problem).

6. C++ versus Python; and Compiled versus Interpreted Language

(a) Python versus C++ use of arrays:

- i. C++: Each item in the array is a data item of some size (so need same type for each item)
- ii. Python: Each item in the array is a memory address for some object (so items can be any type)

(b) Python: Interpreted.

(c) C++: Compiled.

(d) Relevance of difference in terms of memory management.