

## CS100J 16 March 2006 Arrays

Reading: You are responsible for: Secs 8.1, 8.2, 8.3, 8.4

|                 |                    |                   |                    |
|-----------------|--------------------|-------------------|--------------------|
| A decimal point | I'm a dot in place | Slot machines     | Cash lost in 'em   |
| Animosity       | Is no amity        | Parishioners      | I hire parsons     |
| Debit card      | Bad credit         | Schoolmaster      | The classroom      |
| Desperation     | A rope ends it     | Statue of liberty | Built to stay free |
| Dormitory       | Dirty room         | The Morse code    | Here come dots     |
| Eleven plus two | Twelve plus one    | Vacation times    | I'm not as active  |
| Evangelist      | Evil's agent       | Funeral           | Real fun           |
| The earthquakes | That queen shake   | Intoxicate        | Excitation         |
| Mother-in-law   | Woman hitler       | Western Union     | No wire unsent     |

|                           |                            |
|---------------------------|----------------------------|
| Ronald Wilson Reagan      | Insane Anglo Saxon warlord |
| Snooze alarms             | Alas! No more Z's          |
| Victoria, England's queen | Governs a nice quiet land  |
| William Shakespeare       | I am a weakish speller     |
| William Shakespeare       | We all make his praise     |

**Some Anagrams  
(permutations of  
sequences of letters)**

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## Today

- Look at horizontal notation for writing assertions about arrays.
- Develop** several functions that process arrays. The idea is to help you learn how to develop algorithms.
  - Write a function to tell whether two arrays are equal.
  - Write a function to copy an array.
  - Write a function to tell whether two DNA sequences are complements of each other.
- Look at storing a table of values in a Java array.

including adding a value to the table,  
deleting the last value of the table,  
deleting some other value from the table.

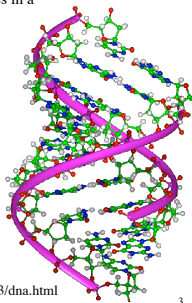
The material on tables is in Sec. 8.4 of course text.

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Deoxyribonucleic acid (DNA) is the building block of all life. Each DNA strand consists of two strings of bases twisted together to form a double helix. The 4 possible bases are represented by G, A, T and C. In a helix, A and T bond together, as do C and G. The two sequences in a helix are complements. For example, these two sequences are complements of each other:

sequence 1: ACGTTAC  
sequence 2: TGCAATG

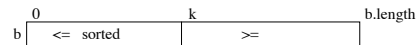
Paired bases meet at an angle. DNA is a very large molecule; the image shows only a tiny fraction of the typical molecule. For the bacterium *Escherichia coli*, the image would be 80 kilometers long. For a typical piece of DNA from an eukaryote cell, the image would stretch from Dallas to Washington, D. C.! DNA is not fully stretched out inside a cell but is wound around proteins, which protect the DNA.



Taken from [www.ucmp.berkeley.edu/glossary/gloss3/dna.html](http://www.ucmp.berkeley.edu/glossary/gloss3/dna.html)

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## Horizontal notation for arrays, strings, Vectors



Example of an assertion about an array *b*. It asserts that:

- $b[0..k-1]$  is sorted (i.e. its values are in ascending order)
- Everything in  $b[0..k-1]$  is  $\leq$  everything in  $b[k..b.length-1]$



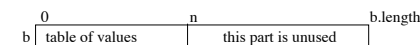
- $b[0..k]$  is sorted (i.e. its values are in ascending order)
- Everything in  $b[0..k]$  is  $\leq$  everything in  $b[k+1..b.length-1]$

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## Maintain a table of values in an array

As a program executes, it may have to maintain a table of values, say temperatures, within an array. The table will start out empty; then values will be added to it. We must say *where* in the array the values are stored.

```
int[] b= new int[5000]; // The n values in the table are in b[0..n-1]
int n= 0;              // 0 ≤ n ≤ 5000
```

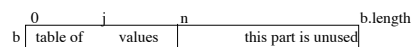


```
// Add t to the table:
b[n]= t;
n= n+1;
```

```
// Delete last element of table
// (assuming it exists).
n= n-1;
```

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## Maintain a table of values in an array



// Delete value  $b[j]$  from the table.

If the order of values in the table doesn't matter:

```
n= n-1;
b[j]= b[n];
```

If the order of values in table does matter:

```
n= n-1;
// Move b[j+1..n] to b[j..n-1]
// inv: b[j+1..k-1] have been moved
for (int k= j+1; k-1 != n; k= k+1 ) {
    b[k-1]= b[k];
}
```

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**An 8th grade test from 1895**

Remember when grandparents and great-grandparents stated that they only had an 8th grade education?

Below is the eighth-grade final exam from 1895 in Salina, Kansas, USA. It was taken from the original document on file at the Smokey Valley Genealogical Society and Library in Salina, KS, and reprinted by the Salina Journal.

8th Grade Final Exam: Salina, KS -1895

(This was a 5-hour test!)

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**An 8th grade test from 1895**

**Grammar (Time, one hour)**

1. Give nine rules for the use of capital letters.
2. Name the parts of speech and define those that have no modifications.
3. Define verse, stanza and paragraph.
4. What are the principal parts of a verb? Give principal parts of "lie," "play," and "run".
5. Define case; Illustrate each case.
6. What is punctuation? Give rules for principal marks of punctuation.
- 7 - 10. Write a composition of about 150 words and show therein that you understand the practical use of the rules of grammar.

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**An 8th grade test from 1895**

**Arithmetic (Time, 1.25 hours)**

1. Name and define the Fundamental Rules of Arithmetic.
2. A wagon box is 2 ft. deep, 10 feet long, and 3 ft. wide How many bushels of wheat will it hold?
3. If a load of wheat weighs 3942 lbs., what is it worth at 50cts/bushel, deducting 1050 lbs. for tare?
4. District No. 33 has a valuation of \$35,000. What is the necessary levy to carry on a school seven months at \$50 per month, and have \$104 for incidentals?
5. Find the cost of 6720 lbs. coal at \$6.00 per ton.
6. Find the interest of \$512.60 for 8 months and 18 days at 7 percent.
7. What is the cost of 40 boards 12 inches wide and 16 ft. long at \$20 per metre?
8. Find bank discount on \$300 for 90 days (no grace) at 10 percent.
9. What is the cost of a square farm at \$15 per acre, the distance of which is 640 rods?
10. Write a Bank Check, a Promissory Note, and a Receipt.

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**An 8th grade test from 1895**

**U.S. History (Time, 45 minutes)**

1. Give the epochs into which U.S. History is divided.
2. Give an account of the discovery of America by Columbus.
3. Relate the causes and results of the Revolutionary War.
4. Show the territorial growth of the United States.
5. Tell what you can of the history of Kansas.
6. Describe three of the most prominent battles of the Rebellion.
7. Who were the following: Morse, Whitney, Fulton, Bell, Lincoln, Penn, and Howe?
8. Name events connected with the following dates: 1607, 1620, 1800, 1849, 1865.

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**An 8th grade test from 1895**

**Orthography (Time, one hour)** Do we even know what this is??

1. What is meant by the following: Alphabet, phonetic, orthography, etymology, syllabication?
2. What are elementary sounds? How classified?
3. What are the following, and give examples of each: Trigraph, subvocals, diphthong, cognate letters, linguals 4. Give four substitutes for caret 'u.' (HUH?) 5. Give two rules for spelling words with final 'e.' Name two exceptions under each rule.
6. Give two uses of silent letters in spelling. Illustrate each.
7. Define the following prefixes and use in connection with a word: bi, dis, mis, pre, semi, post, non, inter, mono, sup.
8. Mark diacritically and divide into syllables the following, and name the sign that indicates the sound: card, ball, mercy, sir, odd, cell, rise, blood, fare, last.
9. Use the following correctly in sentences: cite, site, sight, fane, fain, feign, vane, vain, vein, raze, raise, rays.
10. Write 10 words frequently mispronounced and indicate pronunciation by use of diacritical marks and by syllabication.

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**An 8th grade test from 1895**

**Geography (Time, one hour)**

1. What is climate? Upon what does climate depend?
2. How do you account for the extremes of climate in Kansas?
3. Of what use are rivers? Of what use is the ocean?
4. Describe the mountains of North America.
5. Name and describe the following: Monrovia, Odessa, Denver, Manitoba, Hecla, Yukon, St. Helena, Juan Fernandez, Aspinwall and Orinoco.
6. Name and locate the principal trade centers of the U.S.
7. Name all the republics of Europe and give the capital of each.
8. Why is the Atlantic Coast colder than the Pacific in the same latitude?
9. Describe the process by which the water of the ocean returns to the sources of rivers.
10. Describe the movements of the earth. Give the inclination of the earth.

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