# CS / MCS 401 Week #8-9 Exercises (Spring 2008)

**Exercise P (*optional*).** Illustrate the process of partitioning the array

**36 83 75 48 14 71 64 22 91 69 58 88 72**

using the "one-sided" partitioning algorithm on page 146 of the textbook. See Figure 7.1.

**Exercise Q.** Illustrate the operation of the partitioning algorithm presented in class (see quicksort handout) to partition the array

**36 83 75 48 14 71 64 22 91 69 58 88 72**

using the middle element (64) as the pivot element. Redraw the array after each exchange.

**Exercise R.** Say *partition()* is applied to an array *a* of size *n*, with distinct elements. Let us say that *partition()* produces a bad split if either the left or the right subarray has size less than $n/4$. What is the probability of a bad split if we choose the pivot element as

**a)** a single random element from *a*

**b)** the median of *three* distinct random elements of *a*?

**c)** the median of *five* distinct random elements of *a*?

**d)** the median of *seven* distinct random elements of *a*?

**Exercise S.** Illustrate the algorithm for selecting the $k^{\text{th}}$ smallest element of an *n*-element array in expected linear time (see handout) by finding the 7th smallest element of the array

$A$ = **(54 75 59 83 21 68 41 12 80 61 94 37 29 72 33 88 46)**

of size 17. Use the partitioning algorithm given in the quicksort handout. Specifically, you should list the calls to $partition(a, left, right)$. For each call, give the values of *left* and *right* and the value returned by *partition*(). Draw the array (positions *left* through *right*) before the call to *partition*(), and show the array after *partition*() returns by crossing out elements exchanged and writing their replacements above or below them. Don’t redraw the entire array after each exchange, as you were asked to do in exercise Q above.

**Exercise 9.3-8**