

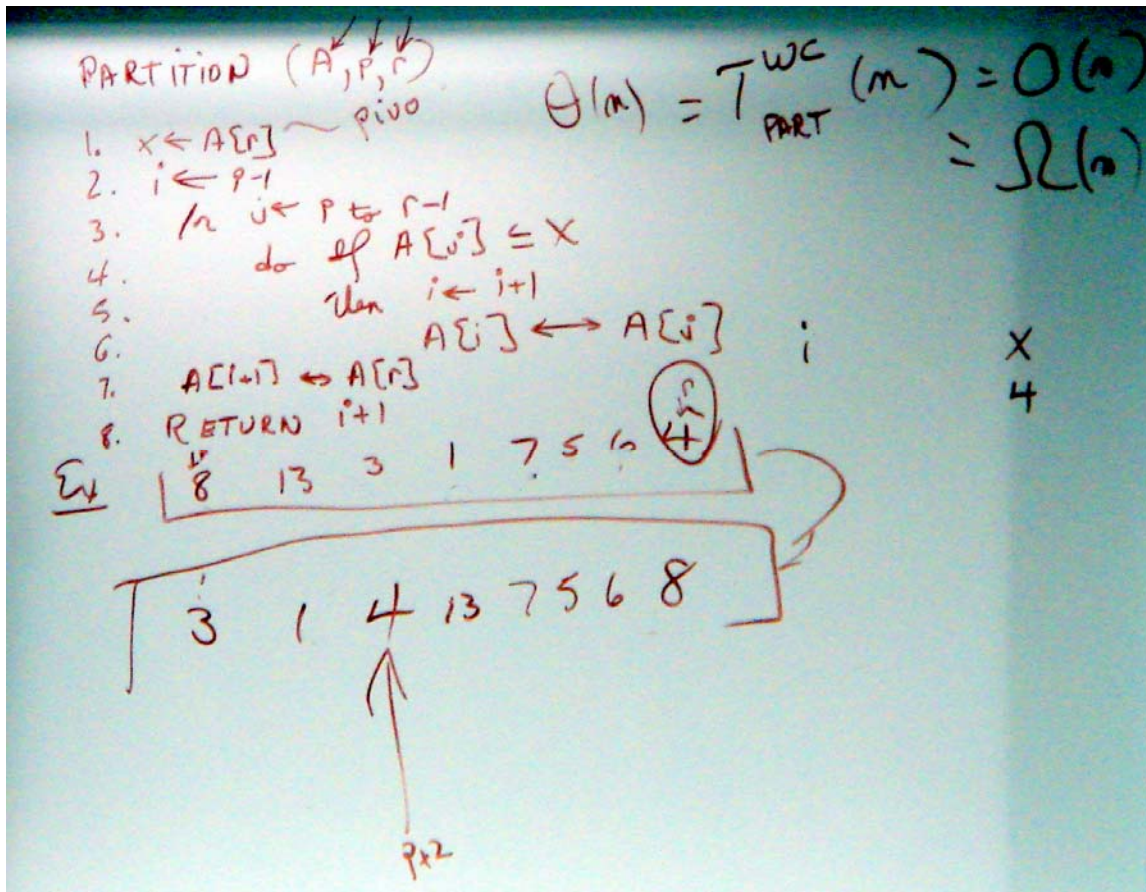
CSCI 303 Introduction to Algorithms
 Spring 2007
 January 29th, 2007 class notes

The first quiz will be on Wednesday, February 7th, 2007. BRING A BLUE BOOK! The quiz will cover homeworks 1, 2, and 3.

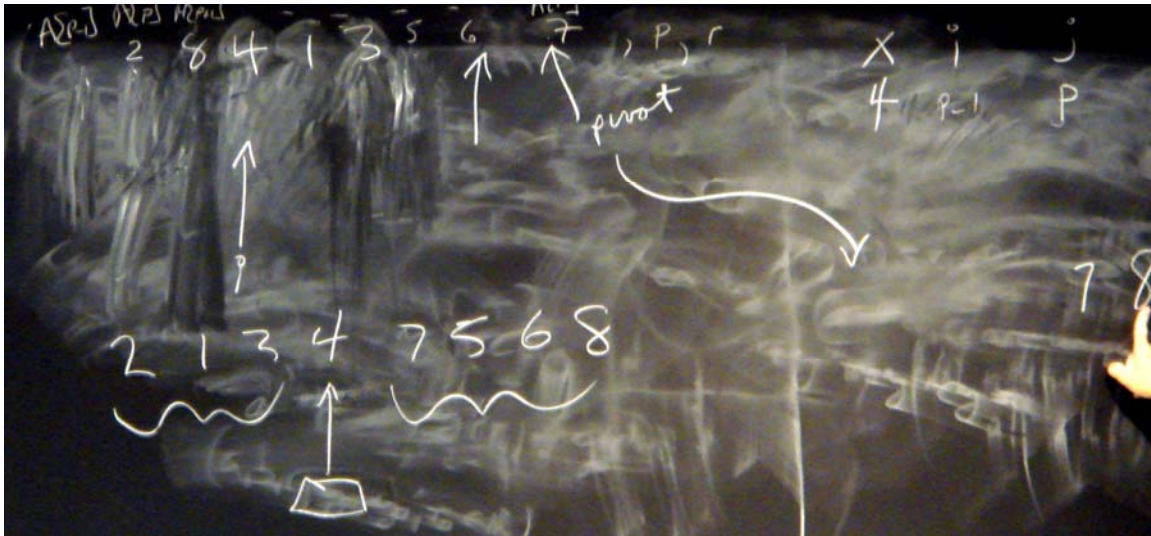
Selection Problem:

Input: a_1, \dots, a_n distinct numbers
 i $1 \leq i \leq n$
 Output: i^{th} order statistic

Let's first examine the algorithm Partition(A, p, r):

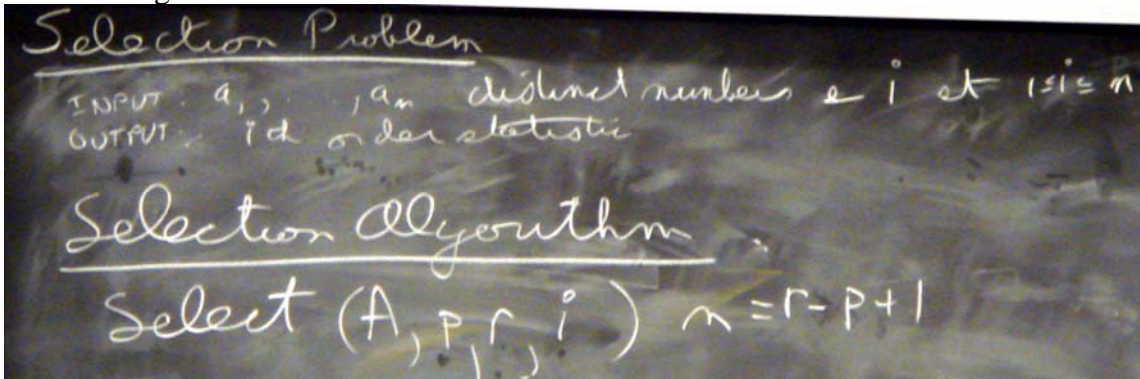


$A[r]$ is called the pivot. Partition divides the list into numbers smaller than and larger than the pivot, and returns the index of the pivot, placed between the two groups.



$$T_{PART}^{WC}(n) = \Theta(n)$$

Selection algorithm:



The Select algorithm will:

1. Chop up A into chunks of 5.
2. Find each set-of-5's "baby" median.
3. Find the super median: the median of the baby medians (call it S).
4. Move S to the end of the list and set $k = \text{Partition}(A, p, r)$.
5. If $i = k$, output S and halt.
 If $i < k$, throw away S and larger elements and recurse $\text{Select}(A, p, p+k-1, i)$
 If $i > k$, throw away S and smaller elements and recurse $\text{Select}(A, p+k+1, r, i-k)$

Select (A, p, r, i)

1. divide list into groups S

2. find "baby medians" $b_1, b_2, \dots, b_{\lfloor \frac{n}{3} \rfloor}$

3. find "Super median" the median of baby medians S

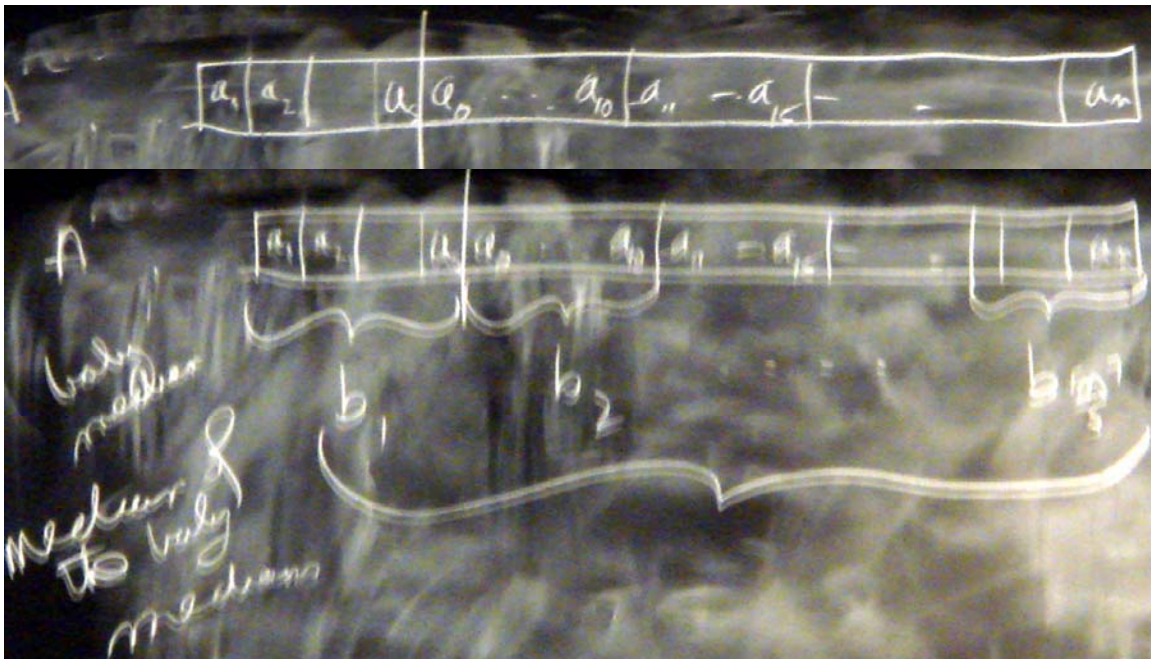
4. switch the last element in list with S

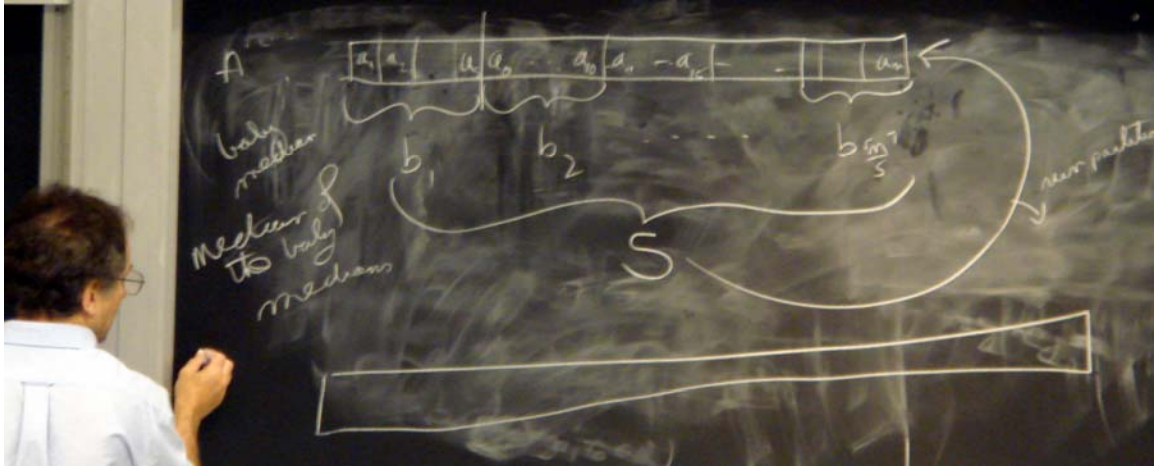
5. $k = \text{PARTIAL}(A, p, r)$

5. i) $k = i$

ii) $k < i$ find $i - k$ th order statistic in $A_{p, k+i}$

iii) $k > i$ " i th " " in $A_{p, k-i}$





$$T_{SELECT}^{WC}(n) \leq T_{PART}^{WC}(n) + \left\lceil \frac{n}{5} \right\rceil c_1 + T_{SELECT}^{WC}\left(\left\lceil \frac{n}{5} \right\rceil\right) + c_2 + T_{SELECT}^{WC}\left(\left\lceil \frac{7n}{10} \right\rceil + 6\right)$$

