Lab W1D6

Question 1. Design and Analysis of the algorithms

(a) Consider an array of "Wooden blocks toys". One of the features of these toys is that they are painted either Blue or Red. Devise an algorithm to keep all the Blue toys together at one end of the array and all Red toys together at the other end of the array. Is your algorithm in place? If not, what is the space complexity? What is the time complexity?

(b) Solve it for three different colors: Blue, Red and Green. . Is your algorithm in place? If not, what is the space complexity? What is the time complexity? Remember we are more concerned about the time complexity.

(c) Solve it for four different colors: Blue, Red, Green and Yellow. Is your algorithm in place? If not, what is the space complexity? What is the time complexity? Remember we are more concerned about the time complexity.

Question 2. Illustrate Quick sort. Since we do not have a random number generator, please pick a pivot so that they lead to alternating between "Good Self Call" and "Bad Self Call".

(a) {1, 2, 3, 4, 5, 6, 7, 8, 9}
(b) {8, 7, 6, 5, 4, 3, 2, 1, 9}
(c) {9, 1, 8, 2, 7, 3, 6, 4, 5}
(d) {5, 1, 4, 2, 3, 9, 7, 6, 8}

Question 3. Illustrate quickSelect. Since we do not have a random number generator, please pick a pivot so that they lead to alternating between "Good Self Call" and "Bad Self Call".

(a) {1, 2, 3, 4, 5, 6, 7, 8, 9} k = 5
(b) {8, 7, 6, 5, 4, 3, 2, 1, 9} k = 3
(c) {9, 1, 8, 2, 7, 3, 6, 4, 5} k = 8
(d) {5, 1, 4, 2, 3, 9, 7, 6, 8} k = 5

Question 4. Exploration

Let us redefine "Good Self Call" and "Bad Self Call"

Good self-call: the sizes of *L* and *G* are each less than 2*n*/3 (normal division)

Bad self-call: one of *L* and *G* has size greater than or equal to 2*n*/3.

(a) Repeat the calculations shown in Slides 15, 16 and 17. (You need not draw pictures).
(b) Are you able to derive the same results in Slides 16 and 17? If not, why?