

CS302 - Midterm 2 Review Questions

1. Probability Questions

- (a) If you have a coin that has $1/4$ probability of heads and $3/4$ probability of tails, what is the sample space if you flip it n times? What is the expected number of heads? (Use indicator random variables).
 - (b) What happens to the randomized search with replacement algorithm from the homework, if there are two elements with value x in the array?
 - (c) Explain why the probability of comparing z_i and z_j in Randomized QuickSort is $2/(|j - i| + 1)$. (We discussed this in class - please explain in your own words.)
2. Suppose you have a graph T that is a binary tree, with weights on each vertex. Let T_v be the subtree with root v . Let $S(T_v)$ be the max-weight-independent set on T_v and let $W(T_v)$ be the weight of the max-weight independent set on T_v . Go through the steps of creating a dynamic programming algorithm.
- (a) What are the options for the optimal solution.
 - (b) For each option, what is the form of the optimal solution in terms of the optimal solution of subproblems.
 - (c) Use this analysis to create a recurrence relation for the maximum value of the objective function.
 - (d) Write pseudocode to fill in an array with values of the objective function