Exam 2 Review
COSC 320: Advanced Data Structures and Algorithm Analysis

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1. All homework, labs, reviews, exams, and lecture notes since exam 1.
2. What is the binary search tree property?
3. What is the Max-Heap property? What is the analagous Min-Heap property?
4. Describe the heap operations and their respective asymptotic runtimes in terms of the number, n, of heap elements.
5. Let $A[1 \cdots n]$ be an n-element array. An *inversion* of A is a pair (i, j) such that $A[i] > A[j]$. Suppose that the elements of A form a uniform random permutation of the numbers $1, 2, \cdots n$ and use indicator random variables to compute the expected number of inversions.
6. What are the five defining properties of a red-black tree?
7. Draw a valid red-black tree with 7 internal nodes that has exactly 3 red nodes. Then give each internal node a value and show the result of inserting 2 more nodes into the tree. Illustrate each "step" that modifies the tree (coloring, rotation, etc.).
8. Show that any n-node BST can be transformed into any other n-node BST by using only $O(n)$ rotations. Hint: first show that $n - 1$ right rotations suffice to transform the tree into a right-going chain.
9. Write a dynamic-programming solution to compute the nth Fibonacci number using at most $O(n)$ operations.
10. Consider a variation of the rod-cutting problem where each cut incurs a fixed cost c. The revenue is then the sum of the prices fetched from each piece, minus the total cost of cutting. Show a dynamic programming solution to compute the optimal profit.