Test 1 Sample Questions

Robin Dawes

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Overview

You can expect questions on the following topics:

- complexity
- binary search
- binary trees
- binary search trees

Complexity

Here are some sample questions:

1. Prove that $f(n) = n^3$ is not in $\Omega(n^4)$

2. Prove that if $f(n)$ is a poynomial function in which all coefficients are positive and k is the largest exponent, then $f(n) \in \Theta(n^k)$

3. Consider this function. Determine its big-O class, its Ω class, and (if possible) its Θ class

```
Complexity(n):
     i = 1
     while (i <= n):
         print(i)
         i = i*2
```

Binary Search

Here is a sample question:

A BITONIC array is one in which all the values are in ascending order until a certain point (called the peak), after which all the values are in descending order. For example

$$A = [3, 7, 8, 12, 7, 2]$$

is a bitonic array in which the peak value is 12.

Write an algorithm that finds the peak value of a bitonic array. Write your algorithm in clear pseudocode.

Binary Trees

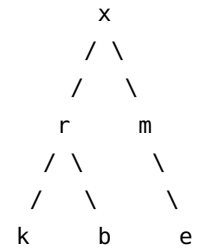
Here are two sample question:

1. How many structurally different binary trees are there on 3 vertices? Show them.

I realize that showing trees is difficult in a typed answer ... that's why this is a practice question rather than a real one!

2. Write an algorithm that will print the values stored in a binary tree, one level at a time, **from the bottom up**

For example, on this tree



the algorithm could print "k, b, e, r, m, x" ... or any other order in which the "k", "b" and "e" are printed in some order, then the "r" and "m" in some order, and finally the "x"

Binary Search Trees

Here is a sample question:

Write an algorithm for a binary search tree class (with standard definitions) that will take a value x as a parameter, and return the number of times x occurs in the tree.