CS 4720/5720 Design and Analysis of Algorithms
Homework #5b
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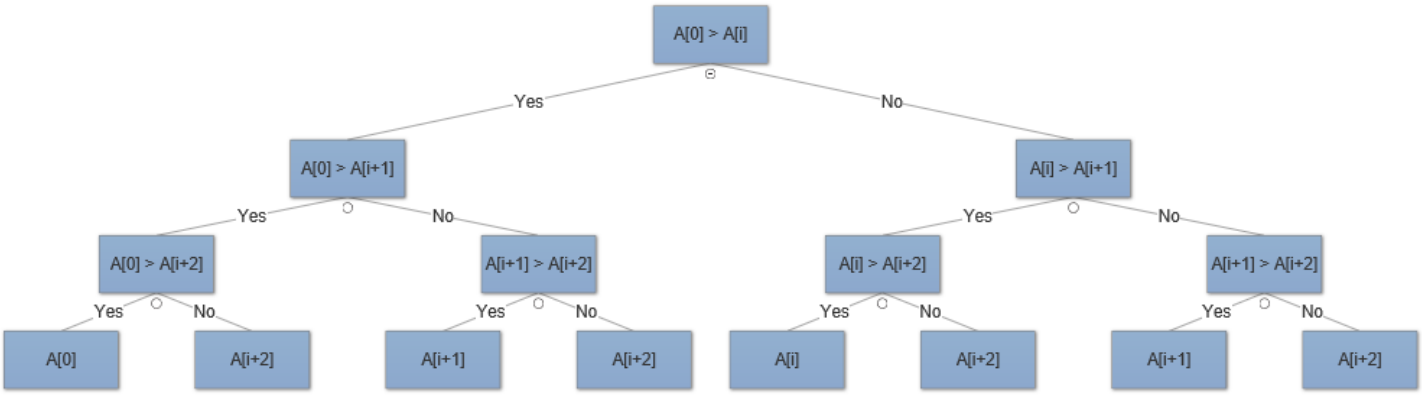
Answers to homework problems:

1. ***Lower bounding on the complexity of array search***

   Trivially, all elements must be checked. A number is only the maximum if every other element "lost" at least once (every other element is less than the maximum), which would require $n-1$ comparisons.

   Consider the decision tree of an array size 3 A[0, 2], it makes $n-1$ comparisons to arrive at an maximum:



2. ***Tractability***

   (a) $\Theta(n \log\log n)$ **running time**

   Tractable since this is bounded by a polynomial.

   (b) $\Theta(5^n)$ **running time**

   Intractable since this is exponential.

   (c) $\Theta(n!)$ **running time**

   Intractable since this is factorial.

3. ***Greedy Knapsack***

   Consider a knapsack with capacity $W = 10$, and items with values $v_i : \{6, 6, 10\}$ and weights $w_i : \{3, 7, 8\}$
   GREEDY: value = 10, weight = 8
   OPT: value = 12, weight = 10
   $r = \frac{12}{10} = 1.2$

   Consider the values $v_i : \{\varepsilon, \varepsilon, 10 - \varepsilon\}$
   $r = \frac{10-\varepsilon}{\varepsilon} = \frac{10}{\varepsilon} - 1 \Rightarrow \varepsilon \to 0 = \infty \therefore$ Greedy Knapsack has an arbitrarily poor performance ratio.