Exam Review 1

Tuesday, September 28, 2021 11:01 AM

Pg 190

- Kruskal & Prims
- Knapsack & Huffmans
- Can you trace an algoritm?
- Can you write pseudocode?
- Practice techniques (ALL)

$$\lim_{n\to\infty} \frac{g(n)}{f(n)} = \begin{cases} c & \text{implies } g(n) \in \Theta(f(n)) \text{ if } c > 0 \\ 0 & \text{implies } g(n) \in o(f(n)) \\ \infty & \text{implies } f(n) \in o(g(n)) \end{cases}$$

Definition

A ***binary search tree*** is a binary tree of items (ordinarily called keys), that come from an ordered set, such that

1. Each node contains one key.
2. The keys in the left subtree of a given node are less than or equal to the key in that node.
3. The keys in the right subtree of a given node are greater than or equal to the key in that node.

ex1: $\log\log n$ & $\log^2 n$

$$\lim_{n\to\infty}\left[\frac{(\log n)^2}{\log\log n}\right]$$

$$\lim_{n\to\infty}\left[\frac{2(\log n)(1/n)}{\left(\frac{1}{\log n}\right)(1/n)}\right] = \lim_{n\to\infty}\frac{2(\log n)}{n}\cdot(n\log n)$$

$$= \lim_{n\to\infty} 2(\log n)\cdot\log n = 2(\log n)^2$$

$$\lim_{n\to\infty} = \frac{2\log^2 n}{c} = \infty \quad \therefore \log\log n \in O(\log^2 n)$$

ex2: Show that $\log\log n \in o(\log^2 n)$ using the definition

$$\log\log n < c\cdot(\log^2 n)$$

Let $c = 2$ $N = 2$

$$0 < 2$$

ex3: $n = 2^{\log n} \rightarrow n^{\log 2} = n$

$$n^{1/\log n} = 2^{\log n(1/\log n)}$$

$$n^{1/\log n} = 2$$

22. Group the following functions by complexity category.

$n \ln n$ $\quad (\lg n)^2$ $\quad 5n^2 + 7n$ $\quad n^{5/2}$

$n!$ $\quad 2^{n!}$ $\quad 4^n$ $\quad n^n$ $\quad n^n + \ln n$

$5^{\lg n}$ $\quad \lg(n!)$ $\quad (\lg n)!$ $\quad \sqrt{n}$ $\quad e^n$ $\quad 8n + 12$ $\quad 10^n + n^{20}$

$n \ln n \in O(n \log n)$

$(\lg n)^2 \in O(\log^2 n)$

3) Show that $\log(n!) \in \Omega(n \log n)$

$\log(n!) = \log(n) + \log(n-1) + \ldots + \log(n/2)$

$\geq \log(n) + \log(n-1) + \ldots + \log(n/2)$ ← $n/2$ terms

$\geq \log(\frac{n}{2}) + \log(\frac{n}{2}) + \ldots + \log(\frac{n}{2})$

$= \frac{n}{2} \log \frac{n}{2}$

$= \frac{n}{2} (\log n - \log 2)$

$\log(n!) = \frac{n}{2} (\log n - 1)$

$\frac{1}{2} (n \log n - n)$

$\left(\frac{3}{2}\right)^n$ vs 2^n