Data Structures Homework for ch. 2 (2):

Celeste (Stacy) Sparks
9-23-21

1) a. $\sum_{i=0}^{n-1}(i^2+1)^2 = \sum_{i=0}^{n-1}(i^4+1+2i^2) = \sum_{i=0}^{n-1} i^4 + \sum_{i=0}^{n-1} 1 + \sum_{i=0}^{n-1} 2i^2$

$= \sum_{i=0}^{n-1} i^4 + ((n-1)-0+1) + 2\sum_{0}^{n-1} i^2$

$= \sum_{i=0}^{n-1} i^4 + n + 2\left(\frac{n(n+1)(2n+1)}{6}\right) = \sum_{i=0}^{n-1} i^4 + n + 1/3n^3$

$= 1/4+1\, n^{4+1} + n + 1/3n^3 = 1/5\, n^5 + n + 1/3n^3 \approx \underline{\Theta(n^5)}$

b. $\sum_{i=2}^{n-1} \lg(i^2) = \sum_{i=0}^{n-1} 2\lg(i) = 2\sum_{i=0}^{n-1} \lg(i) - 2\lg(n)$

$= 2\Theta(n\log n) - \Theta(\log n$

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2) a. Computes the difference between Max and Min of Array

b. Basic Operation = Comparison

c. Executed n-1

d. Efficiency class is $\Theta(n)$

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3) a. $\underline{S(n) = S(n-1)+2} = (S(n-2)+2)+2 = S(n-2)+4$

$= (S(n-3)+2)+4 = S(n-3)+6$

$\Rightarrow \underline{S(n-1)}$ $= S(n-2)+2\times$

$= S(n-(n-1))+2(n-1)$

$= S(1) + S(n-1)$

b. Straight forward non-recursive has the same complexity $\Theta(n)$ as this recursive one.

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4) a. $R_n = P_{n-1} \Rightarrow B_n = R_{n-1} = P_{n-2}$ $TR_1 = 1$

$\Rightarrow TR_n = R_n + B_n = P_{n-1} + P_{n-2}$ $TR_2 = 1$ 12

The Sequence $\{1,1,2,3,5,8,13,21,34,55,89,144\}$

12 Months = 144 pairs

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5)

int = $2^{31}-1 = 2147483637$ long = $2^{63}-1 = 9223372036854775807$

$\underline{f(46) = 1836311903}$ $\underline{F(92) = 7540113804746346429}$