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COSC 3100

Midterm

1. NFA to DFA

	0	1
$\{A, C, E\}$	$\{A, C, D, E, F\}$	$\{B\}$

Answer:

$\{A, C, E\}$ on 0 $\rightarrow \{A, C, D, E, F\}$

$\{A, C, E\}$ on 1 $\rightarrow \{B\}$

2. Asymptotic Notation

compare $\log(n)n$ and $n^{3/2}$

$$\lim_{n \rightarrow \infty} \frac{\log(n)n}{n^{3/2}}$$

$$= \lim_{n \rightarrow \infty} \frac{\frac{1}{n \ln(n)} + \log(n)}{\frac{3}{2} n^{-1/2}} \quad \text{goes to zero}$$

$$= \lim_{n \rightarrow \infty} \frac{\log(n)}{\frac{3}{2} n^{1/2}}$$

$$= \lim_{n \rightarrow \infty} \frac{\frac{1}{n \ln(n)}}{\frac{3}{4} n^{-1/2}} \quad \leftarrow \text{goes to zero}$$

$$= \lim_{n \rightarrow \infty} \frac{0}{\frac{3}{4} n^{1/2}} = 0$$

$$\therefore \log(n)n = o(n^{3/2})$$

little "o"

3. Divide and Conquer Algorithm

(a) n^2 differences

(b) $T(n) = 2T\left(\frac{n}{2}\right) + n^2$

master theorem

compare $n^{\log_2 2} = n$ with n^2

clearly $n^2 > n$

\therefore we are in Case 3

check regularity

$$\frac{2}{2}n < cn^2 \quad c=1 \quad \text{yes, so we are good}$$

$$n^2 = \Omega(n^{1+0.1}) \quad \epsilon = 0.1$$

\therefore we can conclude that
by the master theorem

$$T(n) = \Theta(n^2)$$



	ϕ	A	A-B	A-C	A-D	A-E	A-F	A-G	A-H	A-I	A-J
0:	0	0	0	0	0	0	0	0	0	0	0
1:	0	0	0	0	0	0	0	0	0	2	2
2:	0	0	0	0	0	0	0	0	4	4	4
3:	0	0	0	0	0	0	6	6	6	6	6
4:	0	0	0	0	0	7	7	7	7	8	8
5:	0	0	0	10	10	10	10	10	10	10	10
6:	0	0	11	11	11	11	11	11	11	12	12
7:	0	13	13	13	13	13	13	13	14	14	14
8:	0	13	13	13	13	13	16	16	16	16	16
9:	0	13	13	13	13	17	17	17	17	18	18
10:	0	13	13	13	19	19	19	19	20	20	20
11:	0	13	13	21	21	21	21	21	21	22	22
12:	0	13	13	23	23	23	23	23	23	23	23
13:	0	13	24	24	24	24	25	25	25	25	25
14:	0	13	24	24	24	26	27	27	27	27	27
15:	0	13	24	24	24	28	29	29	29	29	29
16:	0	13	24	24	30	30	30	30	31	31	31
17:	0	13	24	24	32	32	32	32	33	33	33
18:	0	13	24	34	34	34	34	34	34	35	35
19:	0	13	24	34	34	34	36	36	36	36	36
20:	0	13	24	34	34	37	38	38	38	38	38
21:	0	13	24	34	34	39	40	40	40	40	40
22:	0	13	24	34	34	41	41	41	42	42	42
23:	0	13	24	34	43	43	43	43	44	44	44
24:	0	13	24	34	43	43	45	45	45	46	46

This corresponds to:

Do not include J
Include I
Include H
Do not include G
Include F
Do not include E
Do not include D
Include C
Include B
Include A

Giving us the set of items: **{A,B,C,F,H,I}**