YUQIAN ZHANG #N19945556 Recitation: Ojas

Fundamental Algorithms Problem Set 5

Q1.

a) Merge-Sort on n^2 items

$\Theta(n \lg n) \Rightarrow n^2 \lg n^2 \Rightarrow 2 \cdot n^2 \lg n \Rightarrow \boxed{\Theta(n^2 \lg n)}$

b) $n = 2^m$ ANNA takes $\Theta(m^2 2^m)$,

$m = \log_2 n$ $m^2 2^m$

$= (\log_2 n)^2 2^{\log_2 n}$

$= (\log_2 n)^2 n \Rightarrow \boxed{\Theta(n \lg^2 n)}$

c) $n = 2^m$ BOB takes $\Theta(5^m)$

$m = \log_2 n$ 5^m

$= 5^{\log_2 n} \Rightarrow \boxed{\Theta(5^{\lg n}) \text{ or } \Theta(n^{\lg 5})}$

d) COUNTING SORT sort n^2 items with each item in range $0 - n^3 - 1$

According to Complexity time of Counting Sort:

$O(\max(N, k))$ k is $(n^3 - 1)$ here N is n^2.

$\therefore O(n^3 - 1) \Rightarrow O(n^3)$

e) RADIX-SORT take to sort n^2 items with each item in range $0 - n^3 - 1$ and base n is used.

$\because$ base n

item range is $0 - n^3 - 1$

$\therefore D = \log_n(n^3 - 1)$

$\because Max(N, k) = n^2$.

$\therefore O(\log_n(n^3 - 1) \cdot n^2) \Rightarrow O(n^2)$

Q2. Hashing with chaining

A	B	C	D	E	F	G	H	I	J
1	2	3	4	5	6	7	8	9	10
K	L	M	N	O	P	Q	R	S	T
11	12	13	14	15	16	17	18	19	20
U	V	W	X	Y	Z				
21	22	23	24	25	26				

h(COBB) = (3+15+2+2) mod 7 = 1

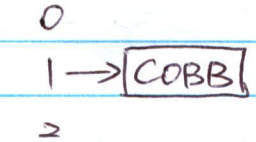
h(RUTH) = (18+21+20+8) mod 7 = 4

h(ROSE) = (18+15+19+5) mod 7 = 1

h(BUZ) = (2+21+26) mod 7 = 0

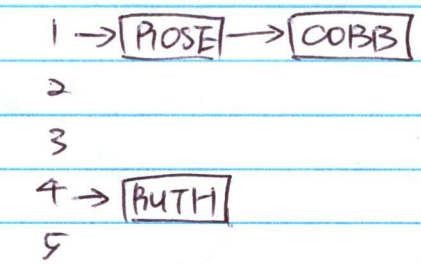
h(DOC) = (4+15+3) mod 7 = 1

Insert(COBB): 1



Insert(RUTH): 4

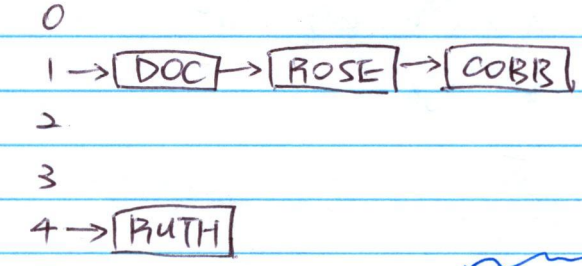
Insert(ROSE): 1



Search(BUZ): 0

go through place 0

Insert(DOC): 1



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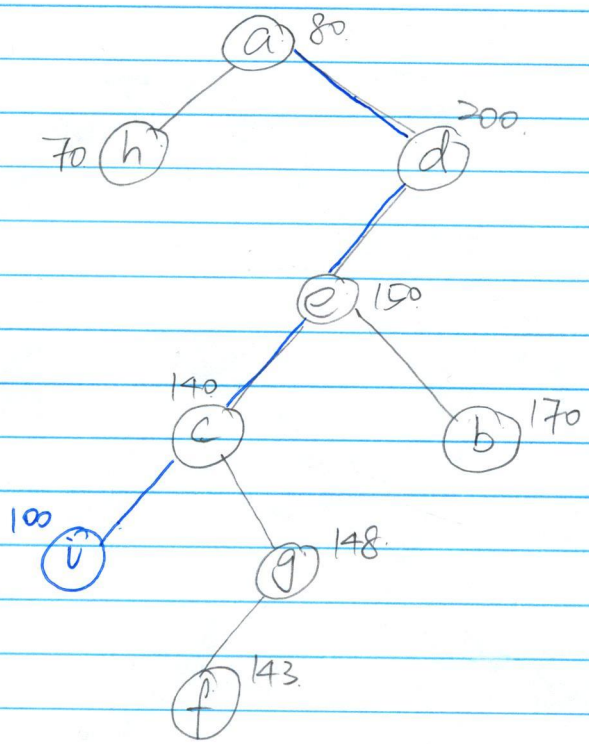
Q3. BST T with vertices a, b, c, d, e, f, g, h ROOT[T] = a



Insert [i] where key[i] = 100

Root → a.right → d.left → e.left → c.left

100 > 80 | 100 < 200 | 100 < 150 | 100 < 140

Q2 continued

Delete COBB: 1

0

1 → [DOG] → [ROSE]

2

3

4 → [PUTIN]

5

6