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CSE 331

HW Set 3

Problem 2

Binary Search

$$T(n) = \begin{cases} T(\frac{n}{2}) + \Theta(1) \quad [\text{constant}] & n \geq 2 \\ \Theta(1) \quad [\text{constant}] & n = 1 \end{cases}$$

Problem 3

$$T(n) = T(\frac{n}{2}) + \Theta(1)$$
$$\Rightarrow b = 2, a = 1, \; f(n) = \Theta(1)$$
$$\Rightarrow f(n) = \Theta(1) = \Theta(n^{\log_b a}) = \Theta(n^0) = \Theta(1)$$

So we use the second Master Theorem
case (2):

$$\Rightarrow T(n) = \Theta(n^0 \lg n)$$
$$\Rightarrow T(n) = \Theta(\lg n)$$

Problem 4

$$T(n) = 2T(\frac{n}{2}) + n^3$$
$$a = b = 2, \; f(n) = n^3$$
$$\log_b a = \boxed{1}$$

$n^3 = f(n) \in \Omega(n^{\log_b a}) = \Omega(n)$

Case 3:

$$\Rightarrow T(n) = \Theta(n^3)$$

Binary Search:

Best Case Performance: O (1)
Worst Case Performance: O (n)

[Avg: O(lg (n))]