

HW Set 3

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CSE 331

Binary Search

$$T(n) = \begin{cases} T(\frac{n}{2}) + \theta(1) & n \geq 2 \\ \theta(1) & n = 1 \end{cases}$$

Problem 3

$$T(n) = T(\frac{n}{2}) + \theta(1)$$

$$\Rightarrow b=2, a=1, f(n) = \theta(1)$$

$$\Rightarrow f(n) = \theta(1) = \theta(n^{\log_2 1}) = \theta(n^0) = \theta(1)$$

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

$$T(n) = 2T(\frac{n}{2}) + n^3$$

$n^3 = f(n) \in \Omega(n^{\log_2 2}) = \Omega(n)$

Case 3:

$$a=b=2, f(n)=n^3$$

$$\log_b a = \boxed{1}$$

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

Binary Search:

Best Case Performance: $O(1)$ Worst Case Performance: $O(n)$ [Avg: $O(\lg(n))$]