1. Work Problem 2.4 on page 71 of your textbook.

2. The following problem is similar to problem 3.5 on page 71 of your textbook. Solve the following recurrences. Give a $\Theta$ bound if possible; otherwise if an $\Omega$ or an $O$ bound.

   (a) $T(n) \leq 5T(n/5) + 1$

   (b) $T(n) = 5T(n/5) + n$

   (c) $T(n) \geq 5T(n/5) + n^2$
(d) \( T(n) = 25T(n/5) + n^2 \)

(e) \( T(n) \leq T(n - 1) + n^4 \)

(f) \( T(n) = 3T(n - 1) + 1 \)

(g) \( T(n) \geq T(\sqrt{n}) + 1 \)
3. Work problem 2.13(a,b) in your textbook.


5. Work problem 2.22 in your textbook.
6. If $f(n)$ is an increasing function, we say that $f$ is *polylogarithmic* if $\log(f(n)) = \Theta(\log \log n)$. We say that $f$ is *polynomial* if $\log(f(n)) = \Theta(\log n)$. We say that $f$ is *exponential* if $\log(f(n)) = \Theta(n)$.

It turns out that not every increasing function falls into one of those classes. Suppose $F$ satisfies the recurrence:

$$F(n) = F(n/2) + F(n - 1) + 1$$

It is obvious that $n < F(n) < 2^n$, so $R$ grows at least as fast as polynomial but no faster than exponential.

(a) Is $F$ polylogarithmic? (Hint: No.)

(b) Is $F$ polynomial?

(c) Is $F$ exponential?