

Practice Problems for Recurrences
CS 336, Spring 2002

1. Solve the following recurrences.
 - (a) $f(0) = 5$ and $f(n) = f(n - 1)$.
 - (b) $f(0) = 5$ and $f(n) = 2f(n - 1)$.
 - (c) $f(0) = 5$ and $f(n) = nf(n - 1)$.
 - (d) $f(0) = 5$ and $f(n) = f(n - 1) + 4n$.
2. Write the following functions recursively. Don't forget the boundary conditions.
 - (a) $f(n) = n^2 + 3n, n = 1, 2, 3, \dots$
 - (b) $f(n) = n^3, n = 1, 2, 3, \dots$
 - (c) $f(n) = 5n!, n = 0, 1, 2, 3, \dots$
 - (d) $f(n) = 4n! + 3, n = 1, 2, 3, \dots$
 - (e) $f(n) = n^n, n = 3, 4, 5, \dots$
3. Write each set recursively.
 - (a) $S = 01^*$
 - (b) $S = 0^+$
 - (c) $S = 01^*0$
 - (d) $S = (011)^*$
 - (e) $S = 1^*01^*$
4. Solve (find closed form) for each set S :
 - (a) $\lambda \in S$ and $s \in S \Rightarrow 0s0 \in S$.
 - (b) $\lambda \in S$ and $s \in S \Rightarrow 0s1 \in S$.
 - (c) $\lambda \in S$ and $s \in S \Rightarrow 1s \in S$.
 - (d) $\lambda \in S$ and $s \in S \Rightarrow ss \in S$.
5. Find upper bounds (good ones!) for the following functions:
 - (a) $f(n) = 3f(n - 1) + n, f(0) = 0$.
 - (b) $f(n) = 3f(n - 1) - n, f(0) = 0$.
 - (c) $f(n) = nf(n - 1) + 1, f(0) = 0$.