COP 3502 Recitation Sheet: Recurrence Relations

We will do a couple in class, but please work on the rest in your groups.

1) (Spring 2020) Use the iteration technique to solve the following recurrence relation in terms of n:

$$T(n) = 2T(n/2) + 1, for\ all\ integers\ n > 1$$
$$T(1) = 1$$

Find a tight Big-Oh answer.

2) What is the closed form solution to the following recurrence relation? Please use the iteration technique, show all of your work and provide your final answer in Big-Oh notation.

$$T(1) = 1$$
$$T(n) = 2T(n/4) + 1$$

3) Use the iteration technique to determine a close form solution for the recurrence relation $T(n)$ defined below. Note: due to the nature of this recurrence, it's possible to get an exact solution for $T(n)$, so please try to do that instead of just getting a Big-Oh bound.

$$T(n) = 2T(n-1) + 2^n$$
$$T(1) = 2$$

4) Using the iteration technique, find a Big-Oh bound for the following recurrence relation, in terms of n:

$$T(n) = 2T\left(\frac{n}{2}\right) + n^2, \text{ for n > 1}$$
$$T(1) = 1$$

5) Use the iteration technique to determine a Big-Oh solution for the following recurrence relation:

$$T(n) = 4T\left(\frac{n}{2}\right) + n^2, T(1) = 1$$

6) (Spring 2026) Determine a closed form solution to the following recurrence relation, in terms of n. (Your solution must be an exact function in terms of n, not a Big-Oh bound.)

$$T(n) = 3T(n-1) + 3^n, \text{ for integers n > 1}$$
$$T(1) = 12$$

7) (Spring 2025) Use the iteration technique to find **an exact closed-form** solution to the recurrence relation defined below for all positive integers n:

$$T(1) = 1$$
$$T(n) = 2T(n-1) + 5, for\ all\ integers\ n \geq 2$$

Please explicitly show the work for the first three iterations before attempting to find the form for an arbitrary iteration, followed by arriving at the closed form. Hint: Your answer should be of the form $T(n) = a(b^n) + c$, where *a*, *b*, and *c* are all integers.

8) (Summer 2024) Using the iteration technique, determine the Big-Oh solution to the recurrence relation below, in terms of ***n***.

$$T(n) = 2T\left(\frac{n}{2}\right) + n^3, \text{ for n > 1}$$
$$T(1) = 1$$

9) (Summer 2023) Use the iteration technique to determine an **exact closed-form solution** for the recurrence relation, T(N), described below. **(Note: Be very careful with what occurs towards the end of the iteration, in the general case.)**

$$T(N) = (N+1)T(N-1) \text{ (for N > 1)}$$
$$T(1) = 1$$

10) (Summer 2022) Using the iteration technique, determine a closed-form solution for the following recurrence relation in terms of n. Note: Your answer should be **EXACT** and not a Big-Oh bound.

$$T(0) = 1$$
$$T(n) = 4T(n-1) + 2^n, for\ integers\ n > 0$$