

Fall 2025

CSCI 2011 Assignment 4: Sequences, Summations, and Algorithms

Due Tuesday 10/7/2025 at 11pm

Answer all 6 questions worth 2.5 points each for a total of 15 points

Question 1:

Find a solution for each of these recurrence relations with the given initial conditions. Use an iterative approach such as that used in Example 10 of section 2.4.

- a) $a_n = -a_{n-1}$, $a_0 = 5$
- b) $a_n = a_{n-1} + 3$, $a_0 = 1$

Question 2:

12. Show that the sequence $\{a_n\}$ is a solution of the recurrence relation $a_n = -3a_{n-1} + 4a_{n-2}$ if

- b) $a_n = 1$.
- c) $a_n = (-4)^n$.

Question 3:

22. An employee joined a company in 2017 with a starting salary of \$50,000. Every year this employee receives a raise of \$1000 plus 5% of the salary of the previous year.

- a) Set up a recurrence relation for the salary of this employee n years after 2017.
- b) What will the salary of this employee be in 2025?
- c) Find an explicit formula for the salary of this employee n years after 2017.

Question 4

For this question, use the formulae in table 2 of section 2.4

32. Find the value of each of these sums.

a)
$$\sum_{j=0}^8 (1 + (-1)^j)$$

b)
$$\sum_{j=0}^8 (3^j - 2^j)$$

c)
$$\sum_{j=0}^8 (2 \cdot 3^j + 3 \cdot 2^j)$$

d)
$$\sum_{j=0}^8 (2^{j+1} - 2^j)$$

Question 5:

Given this list:

1 2 3 5 6 7 8 10 12 13 15 16 18 19 20 22,

- a) What would the linear search return if we pass this list and the value 33 to search for?
- b) What would the linear search return if we pass this list and the value 7?
- c) What would the binary search return if we do the same as for parts a and b for values 33 and 7?
- d) List the steps of searching for value 7 in the above list using the binary search.

Question 6:

- a) Describe an algorithm that takes as input a list of n integers and produces as output the largest difference obtained by subtracting an integer in the list from the one following it.
- b) How many comparison operations does your algorithm perform in terms of the input size n ?