Assignment 1

Due on 2023-05-15 09:00-01:00

1. Which of the following statements are true? (1 point)
   a. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i + b_i \)
   b. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i - b_i \)
   c. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i \times b_i \)
   d. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i / b_i \)

2. Determine the best statement among the following: (2 points)
   a. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i \times b_i \)
   b. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i / b_i \)
   c. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i + b_i \)
   d. \( \sum_{i=1}^{n} a_i \) is the same as \( \sum_{i=1}^{n} a_i - b_i \)

3. Prove the following statement: (3 points)
   \[ \sum_{i=1}^{n} a_i = \sum_{i=1}^{n} a_i \]

4. Consider the following scenario: (4 points)
   a. \( a_i \) is a set of numbers.
   b. \( b_i \) is a set of numbers.
   c. \( c_i \) is a set of numbers.
   d. \( d_i \) is a set of numbers.

5. Implement a function to calculate the sum of the first \( n \) natural numbers: (5 points)

6. Develop an algorithm to find the maximum value in a list: (6 points)

7. Explain the concept of amortized analysis: (7 points)

8. Write a program to sort an array using the quicksort algorithm: (8 points)

9. Design a data structure for efficient insertion and deletion of elements: (9 points)

10. Construct a minimum spanning tree using Kruskal's algorithm: (10 points)

11. Discuss the concept of dynamic programming: (11 points)

12. Implement a function to calculate the factorial of a number: (12 points)