**Mathematical Structures CS**

**Final Exam: (100 pts)**

**Student Name:**

1. Question 1: Explain the concept of a context-free grammar (CFG). Provide an example of a CFG and demonstrate how it can be used to parse a simple arithmetic expression. (20pts)

2. What is a parse tree? Construct a parse tree for the expression (a + a) \* a using the context-free grammar provided in Question 1. (20 pts)

3. Given the sequence an=2n for n ≥0, find the generating function A(x) for the sequence. Show all steps in your calculation. (20pts)

4. Graph (20 pts)

a. How does graph coloring apply to bipartite graphs?

b. Prove that a bipartite graph is 2-colorable?

5. Graph (20 pts)

a: Do BFS for the following graph and find minimum spanning tree.

.b: Do DFS for the following graph and find minimum spanning tree. (20 pts)

