

Assignment 4: Greedy

Overview

The goal of this assignment is to familiarize students with greedy algorithms.

Rules and Deliverables

- This is an individual assignment.
- Cheating of any kind is NOT tolerated! Assignments will be checked against each other, and illegal collaboration will be treated based on the University dishonesty policy.
- The due date will be **Sunday 03/30/2025 at 11:59pm.**
- Submitting the assignment 24 hours after the due date will result in a deduction of 20% from the student's grade.
- Each student must submit the answers document in PDF format, along with clean, bug-free, and easily executable source code (mandatory for Question 1). Do not compress or zip the files.

Assignment Description

1. A set of spherical balloons is taped to a flat wall, represented as the XY-plane. The balloons are described using a 2D integer array point, where $\text{points}[i] = [x_{\text{start}}, x_{\text{end}}]$ represents a balloon with a horizontal diameter spanning from x_{start} to x_{end} .

The exact y-coordinates of the balloons are unknown.

Arrows can be shot vertically (in the positive y-direction) from any position along the x-axis. A balloon with a range $[x_{\text{start}}, x_{\text{end}}]$ will burst if an arrow is shot at any x where $x_{\text{start}} \leq x \leq x_{\text{end}}$

- Arrows travel infinitely upward, bursting any balloon in their path.
- There is no limit to the number of arrows that can be shot.

Your task is to determine the minimum number of arrows required to burst all balloons using a Greedy algorithm.

- Write the pseudocode and explain why the algorithm is greedy. (25 points)
 - Implement pseudocode of the previous bullet point in the programming language of your choice. (15 points)
2. On a hot summer day, a boy wants to buy as many ice cream bars as possible. The store offers n ice cream bars, with their prices given in an array `costs`, where `costs[i]` represents the price of the i -th ice cream bar in coins. The boy has a limited number of coins to spend and can purchase the bars in any order.

Find and explain a Greedy approach to determine the maximum number of ice cream bars he can buy with the given amount of coins. What is the time complexity of the algorithm. (25 points)