

Problem Statement - Amazon Logistics Network Optimization

In Amazon's highly efficient logistics network, minimizing operational overhead and optimizing package routing is crucial to ensuring smooth deliveries across various regions.

The network consists of n warehouses, numbered from 1 to n , each strategically positioned at its corresponding index. Each warehouse has a specific storage capacity, given by `warehouseCapacity`, where `warehouseCapacity[i]` represents the capacity of the warehouse located at position i (assuming 1-based indexing).

These warehouses are organized in a non-decreasing order of their storage capacities, meaning each warehouse's storage capacity is greater than or equal to the one before it.

Each warehouse must establish a connection to a distribution hub positioned at a location greater than or equal to its own. This means that a warehouse at position i can only connect to a hub at position j , where $j \geq i$.

To optimize inventory routing, Amazon has placed a central high-capacity distribution hub at the last warehouse, located at position n .

This hub serves as the main connection point for all warehouses if necessary. The cost of establishing a connection from warehouse i to a hub at position j is given by:

$$\text{warehouseCapacity}[j] - \text{warehouseCapacity}[i]$$

Query Format

Given q queries of the form $(\text{hubA}, \text{hubB})$, where two additional high-performance distribution hubs are deployed at warehouses hubA and hubB , such that:

$$1 \leq \text{hubA} < \text{hubB} < n$$

The goal is to calculate the minimum total connection cost for all warehouses, considering the nearest available distribution hub at or beyond each warehouse's position.

Notes:

- The problem assumes 1-based indexing for the warehouseCapacity array.
- Each query is independent, meaning changes do not persist for subsequent queries.
- Each warehouse connects to the nearest hub at or beyond its position (either hubA, hubB, or the central hub at n) to minimize the overall connection cost.