

**Project 3:** National Parks

**Due date:** Saturday, 05/03/25 @ 11:59pm

Problem Description

Jill is a computer scientist living in Seattle, WA, who has been working for over 20 years as a software development engineering for one of the major corporations in America that designs, manufactures, and sells airplanes. Jill is an adventurer. She recently decided to quit her job and she is ready to move to Miami, FL. She got tired of the cold weather in Seattle, and she is looking forward to living in a place with clear skies, warm-weather, and beautiful white-sand beaches.

However, she hates the idea to fly and being in an airplane for almost six hours. She is determined to drive all the way there and visit National Parks during her trajectory. For that, she marked on a map some of the most beautiful National Parks in USA. She created the following directed acyclic graph (DAG) with distances between them. She is undecided on whether to choose a trajectory with the shortest distance to the state of Florida, or a trajectory that visits the most number of National Parks.



DAG of National Parks – Washington State to Florida State.

Help Jill to decide. Write a C++ program to implement the following:

- 1) Find a topological ordering of the DAG of National Parks using the algorithm described in class (slide 42 of the Dynamic Programming lecture slides in Module 4).
- 2) Then, implement the DAG-Shortest-Paths algorithm (slide 78 of the Dynamic Programming lecture slides in Module 4) to find the shortest path from the North Cascades National Park in Washington to Biscayne National Park in Florida.
- 3) Modify the DGA-Shortest-Paths algorithm to find the path in the DAG of National Parks, which visits the most number of National Parks from the North Cascades National Park to Biscayne National Park.

- 4) Output your results.
  - a. Print the topological order of the National Parks in the DAG of National Parks.
  - b. Print the total distance and the path found in (2).
  - c. Print the total distance and the path found in (3).

#### DAG of National Parks Data

The file “DAG-national-parks.txt” is a tab-delimited file containing an adjacency matrix representation of the DAG of National Parks, where  $A[i, j]$  = the distance between national park  $i$  and national park  $j$ , if  $(i, j)$  is an edge in the DGA of National Parks. Otherwise,  $A[i, j] = 0$ . The order of the rows and columns in the input file correspond to the name of the national parks listed in alphabetical order.

#### Project Structure

This project is an **individual** programming assignment.

#### Deliverables and Grading

Submit ONLY your .cpp and/or header files via Blackboard as attached file. Do NOT submit project folders/files from any IDE environment.

For grading, each submission will be compiled and tested with the sample dataset provided by the instructor. Submissions that do not run to completion will receive no credit. Submissions that take an unreasonable amount of time (e.g. more than a minute or so) to run and do not meet the asymptotic efficiency requirements will receive no credit. All other submissions will receive full credit.

See the course syllabus for Late Work Policies for information about receiving partial credit for late submissions.

**You should NOT be searching the web or other sources for similar code to this.**