Final Project: Traveling Salesman Approximation (100 pts)

For your final project, your job is to implement a heuristic algorithm that approximates a solution to the canonical traveling salesman problem. You must add your solution as part of your ongoing CS 325 web application.

**REQUIREMENTS:** Your app must:
- Use the `/final_project` route for all GET and POST requests
- Use a *textarea* input field to enter a 2D adjacency matrix
  - comma separated integers
  - header row of cities (A,B,...)
  - column header of cities (A,B,...)
  - zeros along the diagonal
  - complete, undirected graph
- Must handle at least 20 cities
- Have a "Compute Path" button that approximates a solution
- Implements a heuristic algorithm (e.g., greedy, genetic, randomized, etc.)
- Have input fields specific to your algorithm of choice (e.g., number of iterations)
- Outputs a valid path:
  - Starts and ends at same node
  - Visits all nodes once
- Outputs the total distance for the path
- Never times out
- Not use a brute-force approach

**GENERAL RUBRIC:**
- A effort: meets requirements, produces valid path with near optimal total distance
- B effort: meets requirements, produces valid path with reasonable total distance
- C effort: meets requirements, produces valid path with poor total distance
- D/F effort: does not produce a valid path and/or uses brute force

**HINTS:**
- Start early
- Work incrementally
- Write code to generate test graphs with known optimal paths
- Verify your path approximation. Is the total correct? Is the path valid?
- Test, test, test
- Does your solution beat mine? (I hope so)
EXAMPLE:
- My approximation uses a genetic algorithm
  - input adjacency matrix
  - set algorithm parameters
  - then click “Compute Path”
My genetic approximation found an optimal path:

- A, B, C, D
- A, B, C, D
- A, B, C, D
- A, B, C, D

Select the genetic algorithm parameters:

- Population: [10, 100]
- # Generations: [100, 10000]
- Recombination Rate: [0, 100%]
- Mutation Rate: [0, 100%]

Heuristic Solution:

- Path: A, B, C, D, A
- Distance: 4