# PROBLEM DESCRIPTION - GROUP 10

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## 2. Topic description

Write a program to find a path with minimum cost between two Vietnamese cities (e.g. Lao Cai and Ha Noi). The vehicle can only travel on road between 2 adjacent cities, or travel by plane if there exists an airway between two cities.

- The problem contains:
    - 32 cities in total.
    - 5 fixed air routes with pre-defined price.
    - 10 fixed toll stations between two cities with pre-defined cost.
- The cost of traveling by road is calculated as follows: road_distance * 1.500 (VND).
- The vehicle is charged after passing any toll stations on the roads.
- The objective is to minimize the amount of money needed to travel from the starting city to the destination.
- The cities list, distance list and air routes list between cities will be read from a file having the following format:
- First line: **n, m, p**. Where:
    - **n** is the number of cities,
    - **m** is the number of city-pairs with road between them along with the price of toll stations between two cities (the price is 0 if there is no toll station),

    - **p** is the number of air routes.
- Next **n** lines: city names
- Next **m** lines: <city_1_name><city_2_name><road_distance_between_2_cities><price_of_toll_stations>
- Next **p** lines: <city_1_name><city_2_name><flight_price>

The starting city and the destination will be initialized randomly. We will find the optimal cost to travel between the starting city and the ending city.
The program will have several outputs:

+ Time complexity (number of nodes expanded in order to solve the route planning problem).
+ Space complexity (number of nodes kept in memory).
+ The path used to solve.
+ The amount of money spent to reach the destination.

## 3. Problem description

Kind of problem: Search problem (branching factors: number of adjacent cities)
States: The locations of the cities.
Initial state: Any randomized starting city location.
Action: Go from one city to another.
Transition model: Successor location after the latest action.
Goal test: Determine whether the current state is the destination.
Path cost: The amount of money spent to travel between 2 cities.