CS201/CS218: Data Structures (Fall 2019)
Final Project

AIRLINE RESERVATION SYSTEM

The airline reservation system facilitates users (or passengers) in finding suitable itinerary across several airliners and destinations.

The passengers usually provide the following information to the airline reservation system for planning their air travel.

- Origin of the air travel.
- Destination of the air travel.
- Date of the travel: Passenger specifies tentative date of the travel. It is important to note that if no flight is available on the specific date, the reservation system provides the flight options within 1 day (before and after) of the tentative date. For example, if there is no flight on 9th June from Islamabad to London, the system will provide the flight options on 8th and 10th June.
- Transits locations: A passenger can optionally specify transit locations along with the preferred transit duration. For example, a passenger can specify that s/he want to have a transit of 19 hours in Dubai while travelling from Islamabad to London.

  It is important to note that a travel to a certain destination might require a transit, i.e., a connecting flight (even if no transit preference is specified by the passenger). For example, in the absence of any direct flight from Islamabad to London, the only possibility might be to have a flight from Islamabad to Dubai and afterwards a connecting flight from Dubai to London. Clearly, in this case the passenger has to stay in Dubai for some hours before boarding on the flight from Dubai to London.

  In the absence of transit preferences, the reservation system try to minimize the transit time.

- Airline of choice: A passenger can optionally specify the preferred airline for the travel.
- Cost or travel time: A passenger specify the criteria to be used by the reservation system for calculating the possible travel options.

On receiving the passenger query (with the above mentioned options), the reservation system calculates the possible travels options according to the criterion selected by the passenger, i.e.,

- Cost: The cost of travel should be minimized. The cost of a connected flight includes the cost of travelling (i.e., ticket price) on each leg of the journey and additionally cost of hotel (if transit time is more than 12 hours).

- Travel time: The travel time should be minimized. The travel time also includes the time of transit.

In addition to the cost and travel time criteria, the travel options calculated by the reservation system also satisfies the constraints specified by the passenger, i.e., preferred airline, transit time preferences etc.

Following table presents some of the use cases that must be handled by airline reservation system:

Passenger Query	Reservation System
Scenario 1: Passenger wants to book a flight of a certain airline going to a certain destination on a specific date with minimal travel cost.	
Origin Destination Date Airline of choice Criterion: Travel cost	Sorted list of flights of the specified airline matching origin, destination as well as date. The list also includes the travel options with connected flights. List will be sorted on the basis of travel cost (including all possible charges explained above). Additionally, the travel time of each option is also specified for information purpose.
Scenario 2: Passenger wants to book a fight going to a certain destination on a specific date with minimal travel time.	
Origin Destination Date of travel Criterion: Travel time	List of all possible flights (may be with connecting flights from different airlines) sorted according to the travel time (including the transit time if any). Additionally, the travel cost of each flight option is also specified for information purpose.
Scenario 3: Passenger wants to book a connecting flight going to a certain destination on a specific date with a transit stay.	
Origin Destination Date of travel Transit location	List of flights matching the constraints (origin, destination, date of travel, transit location). Additionally, the travel cost and travel time of each flight option is also specified for

	information purpose.
Scenario 4: Passenger wants to book a connecting flight going to a certain destination on a specific date having a particular transit time with minimum travel time.	
Origin Destination Date of travel Transit location Min and max transit duration Criterion: Travel time	Sorted list of flights matching the constraints (origin, destination, date of travel, transit location and transit time). The list will be sorted on the basis of travel time (including the transit time). Additionally, the travel cost of each flight option is also specified for information purpose.
Scenario 5: Customer wants to book a non-connecting (i.e., direct) flight going to a certain destination on a specific date and time.	
Origin Destination Date of travel	List of direct flights matching the constraints (origin, destination, date of travel). Additionally, the travel cost and travel time of each flight option is also specified for information purpose.

Above scenarios are only a few possible passenger booking request scenarios in an airline reservation system. Students are supposed to handle any combination of requirements mentioned above.

Instructions

The Flights.txt file contains information about the flights. In particular, each entry in the file contains the following information (in the same order, separated by space)

- Origin
- Destination
- Date of travel
- Flying time
- Landing time
- Ticket price
- Name of airline

It is important to note that the flying and landing times are added in the flight data however the passengers are not give the option to choose the preferred time of fly (rather passengers are can only choose the preferred date of travel). The flying and landing times are included in the flight data for the correct identification of connecting flights and transit times. For example, if a PIA flight from Islamabad to Karachi is from 9:00 AM to 11:00 AM. A passenger cannot take a connecting flight from Karachi with flying time earlier than 11:00 AM. Likewise, a passenger has a transit time of 6 hours in Karachi, if the connecting flight from Karachi is scheduled to fly at 5:00 PM

Moreover, the HotelCharges_perday.txt file contains information about the hotel price if stay is more than 12 hours (or passenger preferred to have a longer transit stay).

Generate a main graph by reading the data provided in Flights.txt and HotelCharges_perday.txt files. For example, the vertices in the graph will be cities and edges represent availability of flights between the cities. Moreover, edges store information about the flights between the two adjacent vertices, e.g., name of airline, ticket price, date of travel, flying time, landing time etc. The hotel price information can also be stored in the vertices of the respective cities.

Given a passenger query, you might generate a sub-graph (that only contains the information relevant to the query) OR/AND adjacency matric/adjacency list to calculate the results of the query. For example, if the passenger has selected Emirates as preferred airline then the cities without Emirate flights are not required to calculate the results of the query.

Good Luck!