Problem 222: Flight Finder

Difficulty: Hard

Authors: Cindy Gibson and Danny Lin, Greenville, South Carolina, United States

Originally Published: Code Quest 2023

Problem Background

Heading to the airport always seems to be such a hassle... finding a parking spot, getting your bags checked, going through airport security, and still making it to your flight on time is enough to get anyone grumpy. However, many people's complaints start long before they leave for the airport... when they try to book their flight in the first place! Airline tickets can be very expensive, and it's often hard to find an itinerary that works with your schedule and doesn't risk leaving you stranded due to a missed connection.

Finding a cheap and practical flight isn't just an issue for tourists, however; businesses often have to wrestle with those same problems. Large companies like Lockheed Martin have to develop policies about what sorts of flights their employees are allowed to purchase and work out fare agreements with major airlines in order to keep costs down. A contracting company like Lockheed Martin often includes the cost of any necessary travel in its bids for contracts, so being able to get cheap flights is crucial to keeping costs to the customer at an absolute minimum.

Problem Description

Lockheed Martin is considering a redesign to its business travel tool, and your team has been asked to work on a tool to identify the best flight itineraries for employees. Your tool will need to enforce Lockheed Martin's policies and risk management guidelines by only recommending itineraries meeting the following criteria:

- All flights must be booked with Lockheed Martin's approved carrier (this will be handled for you; you'll only have information for flights provided by this carrier).
- When a connection is required, the layover time (time between arrival of the first flight and departure of the second) must be at least 60 minutes. Overnight layovers (connections involving flights on different days) are not permitted.
- Employees should arrive either the day before or the day of the start of their event, and should depart either the day of or the day after the end of their event.
- When multiple itineraries meet the above criteria, the one with the lowest total cost should be selected. In the event of a tie, the itinerary with the latest outgoing date should be selected. In the event there is still a tie, the itinerary with the earliest return date should be selected.

Your team will be provided with the schedule of flights available from Lockheed Martin's approved carrier, and with details of trips that need to be made during that year. Given this information and using the criteria above, your program will need to identify the best itinerary for each trip.

Sample Input

The first line of your program's input, **received from the standard input channel**, will contain a positive integer representing the number of test cases. Each test case will include:

- A line containing two positive integers separated by spaces:
  - F, the number of flights available by the airline
  - T, the number of trips that need to be taken in the foreseeable future
- F lines detailing the flights available from the airline. Each line contains the following information, separated by spaces:
  - A positive integer, representing the flight number
  - A three-uppercase-letter code representing the departure airport
  - A time, in the 24-hour format HH:MM, representing the departure time
  - A three-uppercase-letter code representing the arrival airport
  - A time, in the 24-hour format HH:MM, representing the arrival time. This time will always be later than the departure time; no overnight flights will be listed.
  - A string of uppercase letters, indicating the days of the week this flight is held. Letters correspond to days of the week as follows, and will always be presented in this order:
    - S = Sunday
    - M = Monday
    - T = Tuesday
    - W = Wednesday
    - H =Thursday
    - F = Friday
    - A = Saturday
  - A decimal number representing the cost of a ticket on that flight
- T lines detailing the trips that need to be taken. Each line contains the following information, separated by spaces:
  - A three-uppercase-letter code representing the employee's home location
  - A three-uppercase-letter code representing the employee's destination
  - A date, in the format DD/MM/YYYY, indicating the start of the event
  - A date, in the format DD/MM/YYYY, indicating the end of the event

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1
6 2
12 MCO 10:15 DFW 13:00 SMTWHFA 115.10
34 DFW 14:00 MCO 17:45 SMTWHFA 123.50
56 DFW 13:30 BWI 18:00 MWF 140.35
78 BWI 08:05 DFW 12:00 MWF 121.15
90 MCO 09:00 BWI 11:15 SA 290.50
123 BWI 12:30 MCO 15:00 SA 299.99
MCO DFW 26/04/2021 01/05/2021
MCO BWI 26/04/2021 30/04/2021
```

Sample Output

For each test case, your program must print information about the best itinerary for each listed trip. This information must include the following:

- A line containing the phrase "Departure to XXX on DATE", where:
  - XXX is replaced with the three-letter code of the destination airport
  - DATE is replaced with the date of departure in DD/MM/YYYY format.
- One line for each flight in the outgoing leg of the itinerary in chronological order, in the format "Flight NNN from XXX at TIME", where:
  - NNN is replaced with the flight number
  - XXX is replaced with the departure airport for that flight
  - TIME is replaced with the departure time of the flight in 24-hour HH:MM format
- A line containing the phrase "Return to XXX on DATE", where:
  - XXX is replaced with the three-letter code of the origin airport
  - DATE is replaced with the date of return in DD/MM/YYYY format.
- One line for each flight in the returning leg of the itinerary in chronological order, in the format "Flight NNN from XXX at TIME", where:
  - NNN is replaced with the flight number
  - XXX is replaced with the departure airport for that flight
  - TIME is replaced with the departure time of the flight in 24-hour HH:MM format
- A line containing the phrase "Total cost: $", followed by the total cost of all flights in the itinerary. Print two decimal places, including any trailing zeroes.

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Departure to DFW on 26/04/2021
Flight 12 from MCO at 10:15
Return to MCO on 01/05/2021
Flight 34 from DFW at 14:00
Total cost: $238.60
Departure to BWI on 25/04/2021
Flight 90 from MCO at 09:00
Return to MCO on 30/04/2021
Flight 78 from BWI at 08:05
Flight 34 from DFW at 14:00
Total cost: $535.15
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