Math 22 Project

By

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Introduction

- Thousands of planes traverse the United States of America every single day
- Total enplanements are at an all time high
- Many dock at the 5 major US airports.
    - Los Angeles (LAX)
    - Houston (IAH)
    - Atlanta (ATL)
    - New York (JFK)
    - Boston (BOS)
- Markov Chain & Steady State

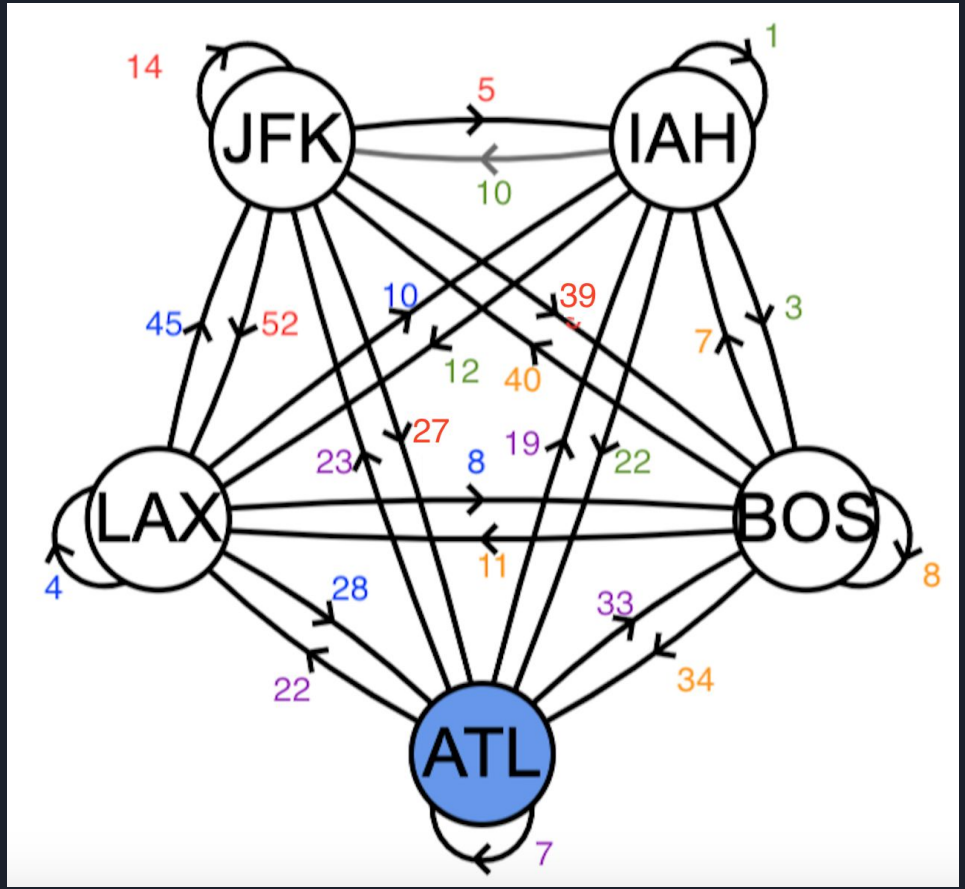
Goal

- To present an informed view of the probability of planes being in each of our 5 given airports

Description

1) Conducted open-source analysis of air traffic data available online
    a) Found information regarding the departures from each major airport daily
2) Created initial network of air traffic flows
3) Optimized the network to find the steady-state solution

Analysis


JFK
IAH
LAX
BOS
ATL
14
1
5
10
45
52
10
39
3
7
12
40
27
23
8
19
22
4
11
8
28
33
22
34
7

Analysis

Table 1: Distribution of Flights, (Number of Flights)

Originates

Lands

	JFK	ATL	BOS	IAH	LAX
JFK	14	23	40	10	45
ATL	27	7	34	22	28
BOS	39	33	8	3	8
IAH	5	19	7	1	10
LAX	52	22	11	12	4

Analysis

Table 2: Distribution of Flights, (*Percent* of Flights)

Originates

Lands

	JFK	ATL	BOS	IAH	LAX
JFK	0.102	0.221	0.400	0.208	0.474
ATL	0.197	0.067	0.340	0.458	0.295
BOS	0.285	0.317	0.080	0.063	0.084
IAH	0.036	0.183	0.070	0.021	0.105
LAX	0.380	0.212	0.110	0.250	0.042

Analysis

Steady State Calculation

To calculate the steady state of the Markov Chain and therein calculate the probability of a plane being in each airport, we calculated the eigenvector of the system.

Steps:

1) No 0 entries in our stochastic (transition) matrix = must be a solution for the steady state of the system
2) If there is a 5X5 stochastic matrix P, the steady state equilibrium vector q in R^5 is a vector such that:

$Pq = 1*q = q$ where our eigenvalue is equal to 1

Analysis

Steady State Calculation (Cont.)

3) We then used an online calculator to row reduce our system of equations to solve for the eigenspace that correlates to the stochastic matrix. Results:

a = 0.173	JFK = a	JFK = 17.3%
b = 0.119	ATL = b	ATL = 11.9%
c = 0.009 →	BOS = c →	BOS = 0.90%
d = 0.051	IAH = d	IAH = 5.1%
e = 0.649	LAX = e	LAX = 64.9%

Percent chance that a plane lies in each airport

Results

Significant findings

Los Angeles (LAX) is the most likely for planes to stay at because:

- Hub for Delta, American, United, and Alaska airlines
- Second busiest airport in the United States
- Los Angeles is on the west coast
    - More likely to be a final destination
    - High demand for early morning flights

Thank you