

Algebra II: Flight Paths over North America

1 Airports in North America

Take a look at the following, ridiculously simplified, map of airports in the United States:

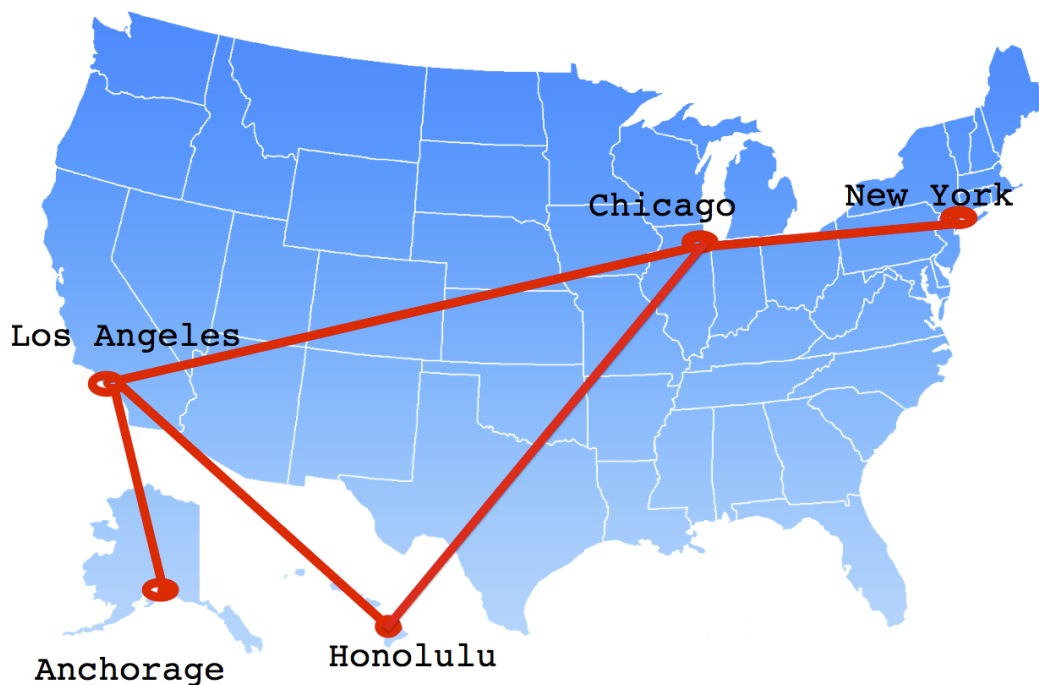


Figure 1: A substantially reduced version of airport flights in the US

- Write down the **adjacency matrix** for the 5 airports and the routes between them. For each column/row in the matrix, put a 1 if a flight goes from the city in the row to the city in the column. Put a 0 if there is no flight.

$$\underline{\mathbf{A}} = \begin{array}{c} \textit{Anc} \\ \textit{Hon} \\ \textit{LA} \\ \textit{Chi} \\ \textit{NY} \end{array} \begin{array}{ccccc} \textit{Anc} & \textit{Hon} & \textit{LA} & \textit{Chi} & \textit{NY} \\ \left[\begin{array}{ccccc} & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \end{array} \right] \end{array}$$

2. How many flights does it take to get from:

(a) Los Angeles to Chicago?

(b) Honolulu to Anchorage?

(c) New York to Honolulu?

3. Now square the adjacency matrix using your calculator

$$\underline{\mathbf{A}}^2 = \underline{\mathbf{A}} \times \underline{\mathbf{A}} = \begin{array}{c} \textit{Anc} \\ \textit{Hon} \\ \textit{LA} \\ \textit{Chi} \\ \textit{NY} \end{array} \begin{array}{ccccc} \textit{Anc} & \textit{Hon} & \textit{LA} & \textit{Chi} & \textit{NY} \\ \left[\begin{array}{ccccc} & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \end{array} \right] \end{array}$$

4. What routes are not 0 in $\underline{\mathbf{A}}^2$ that were 0 in $\underline{\mathbf{A}}$?

5. So what does $\underline{\mathbf{A}}^2$ represent?