Assume the Boolean matrix below is M_R and that M_R represents the relation R where R represents the connecting flights that an airline has between 4 cities: a, b, c, and d. so there is a 1 in row x column y if there is a connecting flight between (from) city x and (to)city y That is, the rows of the matrix represent the cities of the origins of the flight and the columns represent the destination cities.

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array} \begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

(i) Let a stand for the airport in the city of Manchester, let b stand for the airport in Boston, c stand for the Chicago airport, d for the airport in the city of Denver. Is their a flight from Manchester to Chicago?

(ii) Compute and interpret the Boolean products: $M_R{}^2$, and $M_R{}^3$. (Remember to use Boolean arithmetic)

(iii) Now call the given matrix A and compute A^2 and A^3 using **regular** not Boolean arithmetic. What do these products give you.

(iv) Again call the given matrix A and assume there are 3 flights Boston to Chicago and four from Chicago to Denver and compute A^2.

(v) What does $M_R + M_R{}^2 + M_R{}^3 + M_R{}^4$ give you?