

SOLUTION: ANALYSIS OF SEARCH

$$Q = \left\{ \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \mid a_{ij} \in \{0, \dots, k\} \forall i, j \in \{1, 2, 3\} \right\}$$

$$\Sigma = \{ \text{INCREMENT}(i, j) \mid i, j \in \{1, 2, 3\} \}$$

$$\Delta = \left\{ \left(\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}, \text{INCREMENT}(i, j), \begin{bmatrix} a'_{11} & a'_{12} & a'_{13} \\ a'_{21} & a'_{22} & a'_{23} \\ a'_{31} & a'_{32} & a'_{33} \end{bmatrix} \right) \right.$$

$$\left. \begin{array}{l} a'_{i,j} = \begin{cases} a_{i,j} + 1 & \text{if } (i, j) = (i, j) \\ a_{i,j} & \text{otherwise} \end{cases} \right\}$$

$$\left. \left\{ \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}, \begin{bmatrix} a'_{11} & a'_{12} & a'_{13} \\ a'_{21} & a'_{22} & a'_{23} \\ a'_{31} & a'_{32} & a'_{33} \end{bmatrix} \right\} \in Q \right\}$$

$$q_0 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$F = \left\{ \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \mid \begin{array}{l} \sum_{j=1}^3 a_{ij} = k \quad \forall i \in \{1, 2, 3\}, \\ \sum_{i=1}^3 a_{ij} = k \quad \forall j \in \{1, 2, 3\}, \\ a_{11} + a_{22} + a_{33} = k \\ a_{13} + a_{22} + a_{31} = k \end{array} \right\}$$

All solutions are at ^{known} depth $3k$, thus DFS is a more feasible choice (BFS would probably exceed the memory of the machine).