

Discrete Optimization

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Name:

1 Assignment-6

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Please submit your answer in a neat, readable properly organized format.

In general, a * in exercises indicates a more challenging problem, ** a highly challenging problem.

1. Search the internet and find an application that uses an SDR.
2. Express the following matrix as a linear combination of permutation matrices:

$$\begin{pmatrix} 3 & 6 & 0 & 1 \\ 1 & 3 & 1 & 5 \\ 2 & 0 & 4 & 4 \\ 4 & 1 & 5 & 0 \end{pmatrix}$$

3. Construct a cubic graph which does not have a perfect matching.
4. Let A_1, A_2, \dots, A_n be finite sets. Show that if:

$$\sum_{1 \leq i < j \leq n} \frac{|A_i \cap A_j|}{|A_i||A_j|} < 1$$

then the sets A_1, A_2, \dots, A_n have a system of distinct representatives.

5. Do the sets:

$\{2, 4, 7\}, \{1, 7, 3\}, \{2, 4, 7, 3\}, \{3, 5, 1\}, \{3, 6, 2, 4\}, \{1, 2, 3, 4\}, \{5, 2, 4, 7\}$

have an SDR (set of distinct representatives)?

6. If there is a matching M_1 that saturates a set A_1 of vertices and a matching M_2 that saturates another set of vertices A_2 then there is a matching M_3 that saturates $A_1 \cup A_2$ where $a_2 \in A_2$.