1 Theorems from Classes

2 Problem 3.3

Proposition 2.1. The number of non-zero elements you can put into a matrix such that all columns and row of the matrix has no more than 2 elements equals to the minimal number of lines (going horizontally or vertically) on the matrix such that it covers all the non-zero elements.

Proof. Suppose that the matrix A is a $m \times n$ matrix. We firstly need to represent the non-zero elements in the matrix A as edges in the bi-partite graph, and the a row or a column of the matrix as a vertex that in that bipartite graph that covers some of the edges in the bipartite graph.

Define bi-partite graph $G = (V \dot{\cup} V', E)$, where $\dot{\cup}$ is the disjoint union of 2 sets, and we establish notations:

$$V := \{v_i\}_{i=1}^{n} \tag{2.0.1}$$
$$V' := \{v'_j\}_{j=1}^{m} \tag{2.0.2}$$

□

3 Problem 3.5

4 Problem 3.11

5 Problem 3.17