The Theory of Computation
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Solution Manual
Chapter 2, Problem 2.29

The idea here is to map a bipartite graph onto a suitable 0/1 matrix and then show that the result of Exercise 2.28 is equivalent to the statement of this exercise. Fortunately, the mapping is quite simple: given the bipartite graph $G = (\{U, V\}, E)$, we define an $|U| \times |V|$ 0/1 matrix where the ijth entry is 1 if and only if there is an edge between the ith vertex of U and the jth vertex of V. This mapping is clearly a bijection between 0/1 matrices and bipartite graphs. We show that the term rank of this matrix equals the size of the maximum matching. Then we show that the minimum number of rows and columns that contain all nonzero entries equals the size of the minimum cover.

The term rank is the largest number of nonzero entries, no two in the same row or column. Each nonzero entry corresponds to an edge; having no two entries in the same row or column is thus exactly equivalent to requiring a matching—i.e., to requiring that no two edges (nonzero entries) share an endpoint (a row or a column). Thus the term rank is exactly the size of the largest matching.

Containing all nonzero entries is equivalent to covering all edges; rows and columns correspond exactly to vertices. Thus the smallest collection of rows and columns that contain all nonzero entries is exactly the smallest collection of vertices that covers all edges, as we needed to show.

Thus the two theorems (this exercise and Exercise 2.28) are stating the same result in different terms.