The Theory of Computation
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Solution Manual
Chapter 8, Problem 8.15

We prove the problem NP-complete by transforming *MaxCut* to it. We simply let A, the matrix of our problem, be the adjacency matrix of the the graph of *MaxCut* and set the bound K for our problem to $2(|E| - 2B)$, where B is the bound in the instance of *MaxCut*. Given a partition cutting at least B edges, we weight vertices on one side with 1, vertices on the other side with -1; the product $f(i)f(j)$ is 1 whenever both endpoints of the edge are on the same side of the partition, -1 otherwise. Since at least B edges are cut, at least B such products equal -1; there are $|E|$ edges in all, so at most $|E| - B$ are not cut and contribute 1 each and at least B are cut and contribute -1 each, for a total not exceeding $|E| - 2B$. The factor of 2 comes from the fact that the full matrix (symmetric because the graph is undirected) is used. Since we only produce small numbers (0, 1, and K, all linear in the size of the input) and since *MaxCut* (a numberless problem) is itself strongly NP-complete, it follows that *Matrix Cover* is strongly NP-complete.