Algorithms, May-June 2020 at CIS

Homework 2

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1. Suppose we have a set $\{J_1, \ldots, J_r\}$ of jobs to be filled by a pool of s applicants $A_1, \ldots, A_s$. Each job can be filled by at most one applicant and each applicant be assigned to at most one job. Also each job can be filled by only a subset of applicants qualified for the jobs. It is known in advance if a job J_i can be filled by applicant A_j. The goal is to find the maximum number of jobs that can be filled. Formulate this as a maximum matching problem.

2. How many perfect matchings are there in a complete bipartite graph, with $n/2$ vertices on the left and $n/2$ vertices on the right, and for each left vertex u and each right vertex v, there is an edge $\{u, v\}$? There are no edges between two left vertices or between two right vertices.

3. Suppose for any degree n, there is an algorithm to multiply two degree$-n$ polynomials in $O(n \log n)$ time. You can treat this algorithm as a black box. Suppose now you have a degree-n polynomial p and a degree-m polynomial q, and you would like to multily them. Suppose that m is less than n. Describe an algorithm running in $O(n \log m)$ time, using the above black box.