Summer School on Graph Theory and Graph Algorithms

1. Dating Problem [from Ahuja, Magnati, Orlin 1993]. A dating service receives data from p men and p women. These data determine what pairs of men and women are mutually compatible. Since the dating service's commission is proportional to the number of dates it arranges, it would like to determine the maximum number of compatible couples that can be formed. Explain how to formulate this problem as a matching problem. (Note that each man or women is assigned at most one date.)
2. Seat Sharing Problem [from Ahuja, Magnati, Orlin 1993]. Several families are planning a shared car trip on scenic drives in New Hampshire's White Mountains. To minimize the possibility of any quarrels, they want to assign individuals to cars so that no two members of a family are in the same car. Explain how to formulate this problem as a network flow problem. (Hint: the people are the "flow"; make sure you have the right number of people per family and the right number of people per car.)

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Tutorial 3: Problem 3:

A number k of trucking companies, $c_1, \ldots, c_k$, want to use a common road system, which is modeled as a directed graph, for delivering goods from source locations to a common target location. Each trucking company c_i has its own source location, modeled as a vertex s_i in the graph, and the common target location is another vertex t. (All these k + 1 vertices are distinct.) The trucking companies want to share the road system for delivering their goods, but they want to avoid getting in each other's way while driving. Thus, they want to find k edge-disjoint paths in the graph, one connecting each source s_i to the target t. We assume that there is no problem if trucks of different companies pass through a common vertex. Design an algorithm for the companies to use to determine k such paths, if possible, and otherwise return "impossible".