T-79.4201 **Autumn 2006**
Search Problems and Algorithms
Tutorial 1, 21 September
Problems

1. Twelve slightly different types of billets, numbered 1 ... 12, arrive for processing at a factory workshop. The workshop has four machines, numbered I ... IV, and four workers, named A ... D, who have different qualifications for working on the billets. To make things more complicated, there are also four specialised tools, numbered i ... iv, that are needed for processing the various billets. The requirements of machines, tools, and workers for the billets are indicated in the following table:

Machine				Tool				Worker			
I:	1	5	9	i:	1	2	3	A:	1	7	8
II:	2	6	10	ii:	4	9	10	B:	2	3	4
III:	3	7	11	iii:	5	11	12	C:	5	6	12
IV:	4	8	12	iv:	6	7	8	D:	9	10	11

Let's say processing each billet by a combination of the appropriate machine, tool & worker requires 1 hour. Any given machine, tool, or worker can only work on one billet at a time. Since there are 12 billets and 4 machines (as well as tools & workers), processing all the billets requires at least 3 hours. Can it be done in this minimal time?

How would you approach the preceding problem:

(a) By hand? (Design an appropriate schedule!)

(b) By computer, assuming that an arbitrary list of requirements such as above would be given as input? (The numbers of machines, tools, and workers do not need to be the same: this is just a peculiarity of the present example.)

In part (b), you do not need to write any program code, but try to think about how you would approach the task of minimising the completion time for an arbitrary list of requirements.