Exercise 1.1:
Consider the following crossword puzzle, where a given list of words can be used to fill the empty spaces.

```
1  2  3
#  #  
#  4  
6  #  7
8   
```

AFT   LASER
ALE   LEE
EEL   LINE
HEEL  SAILS
HIKE  SHEET
HOSES STEER
KEEL  TIE
KNOT

a) Formalize the problem as a CSP and draw the constraint graph.

b) Reduce the domains of the variables by applying the constraint propagation method arc consistency.

c) Use a search algorithm with forward checking and the degree heuristic to obtain all solutions of the CSP.

Exercise 1.2:
Consider the bridge crossing problem, where 4 persons are on one side of a bridge and all of them need to end up on the other side. It is night and they have only one flashlight. Maximal 2 persons can cross the bridge at the same time and the flashlight needs to be brought back to the remaining persons. Each person walks with a different speed and when they go together they must walk at the rate of the slower man’s pace.

The goal is to find the minimal time for crossing the bridge!

<table>
<thead>
<tr>
<th>person</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 min</td>
</tr>
<tr>
<td>B</td>
<td>2 min</td>
</tr>
<tr>
<td>C</td>
<td>5 min</td>
</tr>
<tr>
<td>D</td>
<td>10 min</td>
</tr>
</tbody>
</table>

a) Design a dynamic programming algorithm to compute the solution!

b) Is there a general procedure which finds an optimal solution for an arbitrary number of people and crossing times?