Exercise Sheet 11
Due: February 1st, 2013

Exercise 11.1 (Nondeterministic progression search, 3 + 2 points)

(a) Model the game Tic-Tac-Toe as a nondeterministic planning task for a grid of size $2 \times 2$ with the goal to get two markers in a row, column or diagonally. Formalize the game from the first player’s perspective. See http://en.wikipedia.org/wiki/Tic-tac-toe if rule questions arise.

(b) Determine a strong plan for this planning task as a graph by providing a solution graph generated by progression search.

Exercise 11.2 (Nondeterministic Planning, 2 + 3 points)

(a) Consider the nondeterministic planning task that induces the following nondeterministic transition system:

![Nondeterministic Transition System](image)

Calculate strong backward distances for all states, starting in the goal states $s_6$ and $s_7$. Derive a strong plan covering all states where such a strong plan exists.

(b) Determine a strong plan for the initial state $s_3$ using AO*-Search. Give the configuration of $T_e$ and $T_p$ in each iteration. It is sufficient to draw the graph $T_e$ (including $f$ and $h$ values), marking the corresponding hyper-edges to visualize $T_p$.

During search, use the heuristic estimates given by the following table:

<table>
<thead>
<tr>
<th>$s$</th>
<th>$1$</th>
<th>$3$</th>
<th>$2$</th>
<th>$2$</th>
<th>$\infty$</th>
<th>$0$</th>
<th>$0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h(\cdot)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The exercise sheets may and should be worked on in groups of two students. Please state both names on your solution (this also holds for submissions by e-mail).