CS347 FS2004 Quiz 2 Key

This is a closed-book test. The only item not supplied that you are allowed (and required) to use, is a pen or pencil. Mark every sheet of paper you use with your name and the string “cs347fs2004 quiz2” (omittance, even if it is partial, will be penalized at 1 point per sheet). If you are caught cheating, you will receive a zero grade for this test. The max number of points per question is indicated in square brackets after each question. The sum of the max points is 45 (including the bonus question). You have exactly 25 minutes to complete this test. Good luck!

All the following questions are about the following state space graph, with A being the start state and D being the goal state. The order in which successors are generated is counterclockwise, ending at exactly 9 o’clock. Example: F generates first D, then B. When sorting by path-cost, nodes with equal path-cost are ordered such that the earlier a node is generated, the higher its priority. Nodes already on the open list have higher priority than newly added nodes with equal path-cost.

1. Give the execution trace for UCTS (hint: use a shorthand notation for repeating sequences of nodes).
   [15]

   open  eval
   A0     A0
   C1     C1
   B2     B2
   G2     G2
   A2     A2
   E3     E3
   D3     D3
goal found; solution = ACGD; path-cost(ACGD)=3

2. Is UCTS complete for this problem? Explain your answer! [2]
   Yes, because it found a solution.

3. Is UCTS optimal for this problem? Explain your answer! [5]
   Yes, because the branching factor is finite, the step costs are all positive, and UCTS is always optimal under those conditions.

4. What is the diameter of this state space? Explain your answer! [3]
   3; this is the largest minimal number of steps between any two nodes.
5. Give the execution trace for DLTS with \( l = 3 \). [10]

<table>
<thead>
<tr>
<th>open</th>
<th>eval</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>A0</td>
</tr>
<tr>
<td>B1C1D1E1</td>
<td>B1</td>
</tr>
<tr>
<td>F2G2A2H2C1D1E1</td>
<td>F2</td>
</tr>
<tr>
<td>D3B3G2A2H2C1D1E1</td>
<td>D3</td>
</tr>
</tbody>
</table>

goal found; solution = ABFD; path-cost(ABFD)=7

6. Is DLTS with \( l = 3 \) complete for this problem? Explain your answer! [2]
   Yes, because it found a solution.

7. Is DLTS with \( l = 3 \) optimal for this problem? Explain your answer! [3]
   No, because UCTS found a solution with lower path-cost.

BONUS Are there state spaces for which DLTS with \( l < \text{diameter} \) is optimal? Explain your answer! [5]
   Yes. For instance, consider a state space where the start state is a goal and has at least one successor; then the diameter is greater or equal to one and DLTS with \( l = 0 < \text{diameter} \) is optimal. Or, alternatively, consider a state space with branching factor equal to one and positive step costs, which contains three states. If the first state reached from the start state is a goal state, then DLTS with \( l = 1 < 2 = \text{diameter} \) is optimal.