1. (a) Describe briefly “The Turing Test”. [5]

The Turing Test was designed to provide a satisfactory operational definition of intelligence, based on indistinguishability from human beings; the computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or not.

(b) In the context of the type of agents that our class studies, give an objection to “The Turing Test”. [5]

Because “The Turing Test” measures intelligence inversely proportional to differentiation from humans, a rational agent will be considered less intelligent if it is more rational than a human.
2. Give the execution trace for UCGS with C being the start state. [15]

<table>
<thead>
<tr>
<th>open</th>
<th>closed</th>
<th>eval</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_0$</td>
<td>-</td>
<td>$C_0$</td>
</tr>
<tr>
<td>$A1F5$</td>
<td>$C$</td>
<td>$A1$</td>
</tr>
<tr>
<td>$B3D3F5$</td>
<td>$CA$</td>
<td>$B3$</td>
</tr>
<tr>
<td>$D3F5$</td>
<td>$CAB$</td>
<td>$D3$</td>
</tr>
<tr>
<td>$F4E6$</td>
<td>$CABD$</td>
<td>$F4$</td>
</tr>
<tr>
<td>$E6G6H6$</td>
<td>$CABDF$</td>
<td>$E6$</td>
</tr>
<tr>
<td>$G6H6$</td>
<td>$CABDFE$</td>
<td>$G6$</td>
</tr>
<tr>
<td>$H6$</td>
<td>$CABDFEG$</td>
<td>$H6$</td>
</tr>
</tbody>
</table>

Goal found; solution = $CADFH$; path-cost($CADFH$) = 6

3. Is UCGS complete for this problem? Explain your answer! [5]
Yes, because it found a solution.

4. Is UCGS optimal for this problem? Explain your answer! [5]
Yes, because:
- all routes to $H$ go via $F$ so we can decompose the problem into optimizing the path from $C$ to $F$ and from $F$ to $H$,
- $CADF$ has a path-cost of 4 which is lower than $CF$ (5), $CABDF$ (5), $CADEF$ (5) and $CABDEF$ (6),
- $FH$ has a path-cost of 2 which is lower than $FGH$ (3),
so $CADFH$ is optimal and that is the solution found by UCGS.

5. Give the execution trace for DFTS with B being the start state. [15]

<table>
<thead>
<tr>
<th>open</th>
<th>eval</th>
</tr>
</thead>
<tbody>
<tr>
<td>$B$</td>
<td>$B$</td>
</tr>
<tr>
<td>$DA$</td>
<td>$D$</td>
</tr>
<tr>
<td>$EFABA$</td>
<td>$E$</td>
</tr>
<tr>
<td>$FDFABA$</td>
<td>$F$</td>
</tr>
<tr>
<td>$GHCDDFABA$</td>
<td>$G$</td>
</tr>
<tr>
<td>$HFHCDDFABA$</td>
<td>$H$</td>
</tr>
</tbody>
</table>

Goal found; solution = $BDEFGH$; path-cost($BDEFGH$) = 6

6. Is DFTS complete for this problem? [5]
Yes, because it found a solution.

7. Is DFTS optimal for this problem? [5]
No, because $BDFH$ has a path-cost of 4 which is lower than what DFTS found.
8. Give the execution trace for ID-DFGS with E being the start state. [15]

\[
\begin{array}{ccc}
\text{depth-limit}=0 \\
\text{open} & \text{closed} & \text{eval} \\
E0 & - & E0 \\
\text{depth-limit reached and no goal found}
\end{array}
\]

\[
\begin{array}{ccc}
\text{depth-limit}=1 \\
\text{open} & \text{closed} & \text{eval} \\
E0 & - & E0 \\
F1D1 & E & F1 \\
D1 & EF & D1 \\
\text{depth-limit reached and no goal found}
\end{array}
\]

\[
\begin{array}{ccc}
\text{depth-limit}=2 \\
\text{open} & \text{closed} & \text{eval} \\
E0 & - & E0 \\
F1D1 & E & F1 \\
G2H2C2D1 & EF & G2 \\
H2C2D1 & EFG & H2 \\
\text{goal found; solution = EFH; path-cost(EFH)=1}
\end{array}
\]

   Yes, because it found a solution.

10. Is ID-DFGS optimal for this problem? [5]
    Yes, because:
    \begin{itemize}
    \item all routes to H go via F so we can decompose the problem into optimizing the path from E to F and from F to H,
    \item any path from E to F via D will have a path-cost greater or equal to the step-cost from E to D which is 3, while the path-cost from E to F is -1 which is lower,
    \item FH has a path-cost of 2 which is lower than FGH (3),
    \end{itemize}
    so EFH is optimal and that is the solution found by ID-DFGS.

11. What is the diameter of this state space? Explain your answer! [5]
    3; this is the largest minimal number of steps between any two nodes.

12. Is DLTS with \( l = \text{diameter} \) and A as start state complete for this problem? Explain your answer! [5]
    Yes, because the branching factor is finite and DLTS with \( l = \text{diameter} \) is always complete in that case.

13. Is DLTS with \( l = \text{diameter} \) and A as start state optimal for this problem? Explain your answer! [5]
    Yes, because the only two paths of length 3 from A to H are ADFH and ACFH, ADFH will be tried first, and it has the lower path-cost, and the only subpath alternatives for ADFH are ABD for AD, DEF for DF, and FGH for FH, which all would result in increased path-cost.

BONUS Is ID-DFGS optimal for Plank Puzzles? Explain your answer! [5]
   The answer is yes if you choose the step-costs to be equal because ID-DFGS is optimal under that condition.