**COMP 3710 Artificial Intelligence**

Fall 2017

Term test I

Student Name: Student Number:

1. (2 marks) Define what an admissible heuristic is, with an example.
2. (6 marks) Answer the following questions about the 8-Puzzle game, i.e., 3×3.
3. Design a formal representation of problem state, i.e, a data structure with brief explanation.
4. Give an initial state and the goal state, using the formal representation that you designed in a).
5. Give all the possible next states after the above initial state.
6. (5 marks) Answer the following questions about A\* algorithm.

* Nodes: *A*, *B*, *C*, *D*, *E*, *K*, *G*, *H*, *I*, *J*, …
* *g*: g-value; *h*: h-value; *p*: parent node
* Current *ExpandedQ*: [ *A*:{*g*=8, *h*=10, *p*=*K*}, *B*:{*g*=7, *h*=12, *p*=*C*}, *D*:{*g*=9, *h*=11, *p*=*C*},

*E*:{*g*=10, *h*=8, *p*=*K*} ]

* Current *VisitedQ*: [ *D*, *F*, *H*, *K*, *C*, *J* ]
* Current node: *G*:{*g*=3, *p*=*J*} that is connected to *B*, *F*, *H*, *J* with costs 2, 3, 2, 1 respectively.
* Let’s assume that *G* is not a goal node. (Questions are on the next page.)

1. Update *ExpandedQ* after *G* is visited.
2. Update *VisistedQ* after *G* is visited.
3. Which node should be selected and visited next time?
4. (3 marks) We would like to solve the 5-queens problem using a local search algorithm. In this algorithm, you need to move a queen that conflicts with the most number of other queens, so that the next state can be improved.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 |  |  |  | Image result for queen  symbol |  |
| 2 |  |  | Image result for queen  symbol |  |  |
| 3 |  |  |  |  |  |
| 4 | Image result for queen  symbol |  |  |  |  |
| 5 |  | Image result for queen  symbol |  |  | Image result for queen  symbol |

a b c d e

1. Which queen conflicts with the most number of other queens?
2. To which position do you need to move the above queen?
3. Explain how the next state becomes improved.
4. (3 marks) We would like to solve the 5-queens problem using Most-Constrained Variable First heuristic.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 |  |  |  |  |  |
| 2 |  | Image result for queen  symbol |  |  |  |
| 3 |  |  |  | Image result for queen  symbol |  |
| 4 | Image result for queen  symbol |  |  |  |  |
| 5 |  |  |  |  |  |

a b c d e

Decide the next variable and its value, and explain briefly why the variable and the value are chosen.