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<u>**3.1 PRE-CLASS WORK (3.14 FROM RUSSEL & NORVIG)**</u>

Which of the following are true and which are false? Explain your answers.

1. <u>**Depth-first search always expands at least as many nodes as A* search with an admissible heuristic**</u>.
   FALSE. Depth-first search might luckily find a shorter path than A* search without backtracking. For example, if the shortest path to the goal involves traversing a node with a higher g(n) + h(n) than its neighbour, DFS might luckily pick that path on first try and reach the goal node, while A* will traverse the neighbour node first.

2. <u>**h(n) = 0 is an admissible heuristic for the 8-puzzle.**</u>
   TRUE. The condition for admissibility is that the cost to the goal state is never overestimated. This is true for h(n)=0 as the true cost to the goal from any node will never be less than or equal to 0 (h(n)= 0 is the goal node).

3. <u>**A* is of no use in robotics because percepts, states, and actions are continuous.**</u>
   FALSE. A* search is relevant in the search phase of problem-solving. This phase makes use of input in continuous form (continuous state representation for problem formulation phase from continuous percepts) assigns a usually discrete concept of cost to the states, and sends out as output a continuous action to be carried out to reach other states (action phase). Thus, it is utilized in a different discretized phase than these continuous elements.

4. <u>**Breadth-first search is complete even if zero step costs are allowed.**</u>
   TRUE. BFS is complete whenever the branching factor and depth are finite (regardless of the step costs). Step costs only affect its optimality. When the cost of each action is the same, BFS is optimal. This is the case with zero step costs for each action.

5. <u>**Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves.**</u>
   FALSE. Manhattan distance is hinged on the fact that each action performed can only move the piece(rook) one step closer to the goal state. This is not the case in this problem as the rook can be moved any number of squares closer to the goal. Therefore in this scenario, the Manhattan distance overestimates the cost to the goal and so is not admissible.