**Total # of points = 80.**

**1. [10 points]** What are the time complexity and space complexity for the following inference methods in propositional logic: (a) *truth-table enumeration*, (b) *forward chaining* and (c) *resolution*? Define the parameters you use.



**2. [15 points]** In the Wumpus world, the agent has just moved from square [1,1] to square [2,1] and detected breeze in both squares. The agent was given the knowledge that “squares adjacent to a pit are breezy.” The agent would like to determine whether square [2,2] is safe or not (a square is safe if it does not have a pit.) In the figure below, circle those models that belong to the knowledge base (KB) and circle those models that belong to = square [2,2] is safe. From the models that you have circled, use *model checking* to determine whether KB entails or not. (The Wumpus world has 16 squares but only 5 are shown below.)





Indices for squares

**3. [15 points]** Given the following sentences in a propositional logic knowledge base (*KB*). Use *truth table enumeration* to find out whether or not *KB* |= *α*, where α is the sentence. Show all work.

*KB:*

**4. [20 points]**  In a 2 x 2 Wumpus world as shown in the figure below, the agent has just moved from location (1,1) to location (2,1) and detected breeze in location (2,1). The agent did not detect breeze in location (1,1). The agent also has the following rule in its knowledge base: *squares adjacent to pits are breezy*.

* 1. Use propositional logic to represent *all* the rules and observations in the knowledge base of the agent. Use symbol *P* to represent pits and *B* to represent breeze. (Reminder: variables are not allowed in propositional logic.)
  2. Use resolution to show that square (2,2) is not safe. Show all work.

|  |  |
| --- | --- |
| (1,2) | (2,2) |
| (1,1) | (2,1) |

**5. [20 points]** Given the following propositional logic sentences in a knowledge base *KB,* use *resolution* to prove that the knowledge base entails the sentence *G*; i.e., KB |= *G.* Show all work to get full credits.

KB:

G: