CSCI 5582 Fall 2002 Final

Name: ________________________

On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work. ________________________________.

I. The following questions address the topic of Search.

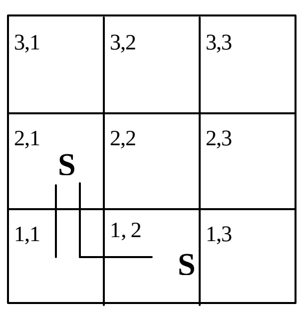
1. **(5 points)** Which of the following search algorithms make efficient use of available memory?
   - Depth-first
   - A*
   - Uniform-cost
   - IDA*

2. **(5 points)** True or False: IDA* is always a reasonable alternative to an A* search (assuming they use the same f-cost).

II. The following questions address the topic of Logic.

1. Recall the following Wumpus world rule from the text: when the agent detects a Stench in a location, it means that the Wumpus is in an adjacent location (up, down, left, or right). Assume there is only one Wumpus (Note: the rules given for the game in the textbook are not restricted to a single Wumpus; you should change the rules as needed to capture this fact).

   Our agent travels the path shown in the following figure.

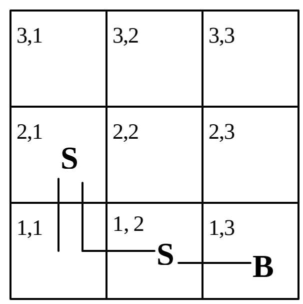


a. **(5 points)** What is the state of the agent's knowledge base with respect to the location of the Wumpus at the point where it has moved from [1,1] to [2,1] and detects the Stench there? More specifically, show this using Propositional Logic and show all the inferences and rules needed to produce your conclusions.

b. **(15 points)** Show the state of the agent's knowledge base with respect to the Wumpus at the point where it has moved back through [1,1] to [1,2] and detects the Stench in [1,2]. Again show all your work.

III. The following questions address the topic of uncertainty.

1. Consider the following Wumpus situation, which extends the one described in the last question. The only differences are that the agent has moved on to [1,3] and has detected a breeze, and you are now told that there are exactly 2 pits, and that one location holds the gold (not in a pit and not with the Wumpus). Recall that, unlike stenches and breezes, the glitter of gold is only detected in the cell where it is found.



   a. **(5 points)** Your agent has been endowed with the ability to reason probabilistically. At this point, what probability should it assign to its belief that it can win this game (get to the gold)? Note this question does not require you to show any fancy probability or logic techniques; simple counting and dividing will suffice.

2. Consider the training data in the following table.

#	F1 (In/Out)	F2 (Meat/Veg)	F3 (Red/Green/Blue)	Label
1	In	Veg	Red	Yes
2	Out	Meat	Green	Yes
3	In	Veg	Red	Yes
4	In	Meat	Red	Yes
5	In	Veg	Red	Yes
6	Out	Meat	Green	Yes
7	Out	Meat	Red	No
8	Out	Veg	Green	No

a. **(10 Points)** Describe in detail a naïve Bayes classifier constructed from this data.

b. **(5 Points)** Given your classifier from the previous part, classify the following object [F1=Out,F2=Meat,F3=Green]

3. It is possible to view a naïve Bayes classifier as a Bayesian Belief Network.
    a. **(10 Points)** Reformulate your solution to the previous problem as a belief net. Show all the required probability tables.

    b. **(5 Points)** Classify the following object using your belief net [F1=Out, F3=Red] (this means formulate the classification question as one or more probability assessments for your Belief Net.)

IV. The following questions address the topic of Machine Learning with respect to the following training set.

#	F1 (In/Out)	F2 (Meat/Veg)	F3 (Red/Green)	Label
1	In	Meat	Red	Yes
2	Out	Veg	Green	Yes
3	In	Meat	Red	Yes
4	Out	Veg	Red	Yes
5	In	Veg	Green	No
6	Out	Meat	Green	No
7	In	Veg	Red	No
8	Out	Meat	Green	No

1. **(10 Points)** Show the complete tree that the standard decision tree learning algorithm would produce for this training set.

2. **(10 Points)** Show a nice small 2-DL decision-list that would be produced by a covering-style decision-list learning algorithm.

V. The following question addresses the topic of Language processing.
(15 points)

You've recently take a job with the local daily newspaper. This paper receives a substantial number of articles from a national newswire. Unfortunately, these articles can't be published directly since they arrive as all caps (i.e. THEY ARRIVE LOOKING LIKE THIS). Unfortunately, the experienced typesetter who has fixed the text by hand has just retired. Having just finished this class, you volunteer to write a program that performs the same task as well as the retiree. To be specific, any given input word might be translated three ways: all caps (IRE), capitalized (Ire), or lower-case (ire).

Describe, in detail, the framework you would use in solving this problem. Include in your description, the algorithms that would be needed in this framework and the sources of information that these algorithms would require.