CMPT 310, Spring 2019, Written Assignment 04

Due date: February 04, 2019

Problem 1. Consider the problem of placing k knights on an $n \times n$ chessboard such that no two knights are attacking each other, where k is given and $k \leq n^2$.

(a) Choose a CSP formulation. In your formulation, what are the variables?

(b) What are the possible values of each variable?

(c) What sets of variables are constrained, and how?

Problem 2. Consider a vocabulary with only four propositions, A, B, C and D. How many models are there for the following sentences?

(a) $B \vee C$.

(b) $\neg A \vee \neg B \vee \neg C \vee \neg D$.

(c) $(A \Rightarrow B) \wedge A \wedge \neg B \wedge C \wedge D$.

Problem 3 (Optional). Suppose the agent has progressed to the point shown in Figure 1, having perceived nothing in $[1, 1]$, a breeze in $[2, 1]$, and is now concerned with the contents of $[1, 3]$, $[2, 2]$, and $[3, 1]$. Each of these can contain a pit, and at most one can contain a wumpus. Following the example of Figure 2, construct the set of possible worlds. (You should find 32 of them). Mark the worlds in which the KB is true and those in which each of the following sentences is true:

$\alpha_2 =$ "There is no pit in $[2, 2]$"
$\alpha_3 =$ "There is a wumpus in [1,3]"

Problem 4 (Optional). Prove, or find a counterexample to, each of the following assertions:

(a) If $\alpha \models \gamma$ or $\beta \models \gamma$ (or both) then $(\alpha \wedge \beta) \models \gamma$.

(b) If $\alpha \models (\beta \wedge \gamma)$ then $\alpha \models \beta$ and $\alpha \models \gamma$.

(c) If $\alpha \models (\beta \vee \gamma)$ then $\alpha \models \beta$ or $\alpha \models \gamma$ (or both).

Problem 5 (Optional). We have defined four binary logical connectives.

(a) Are there any others that might be useful?

(b) How many binary connectives can there be?

(c) Why are some of them not very useful?

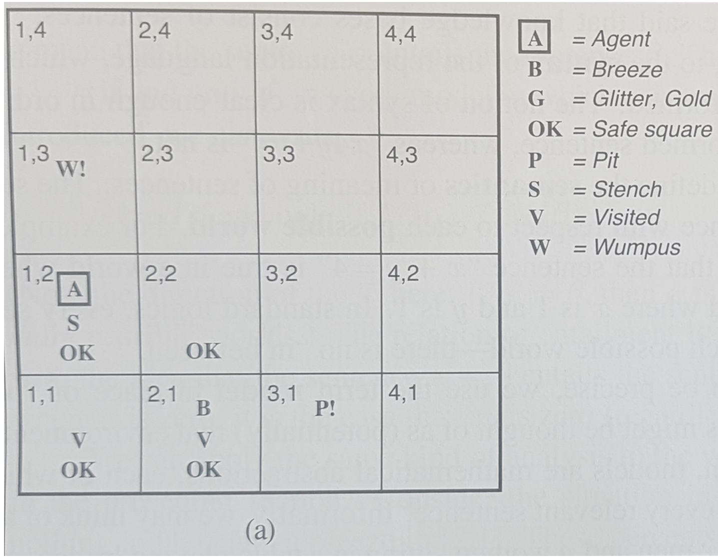

Figure 1: Question 3 - Stage in the progress of the agent.

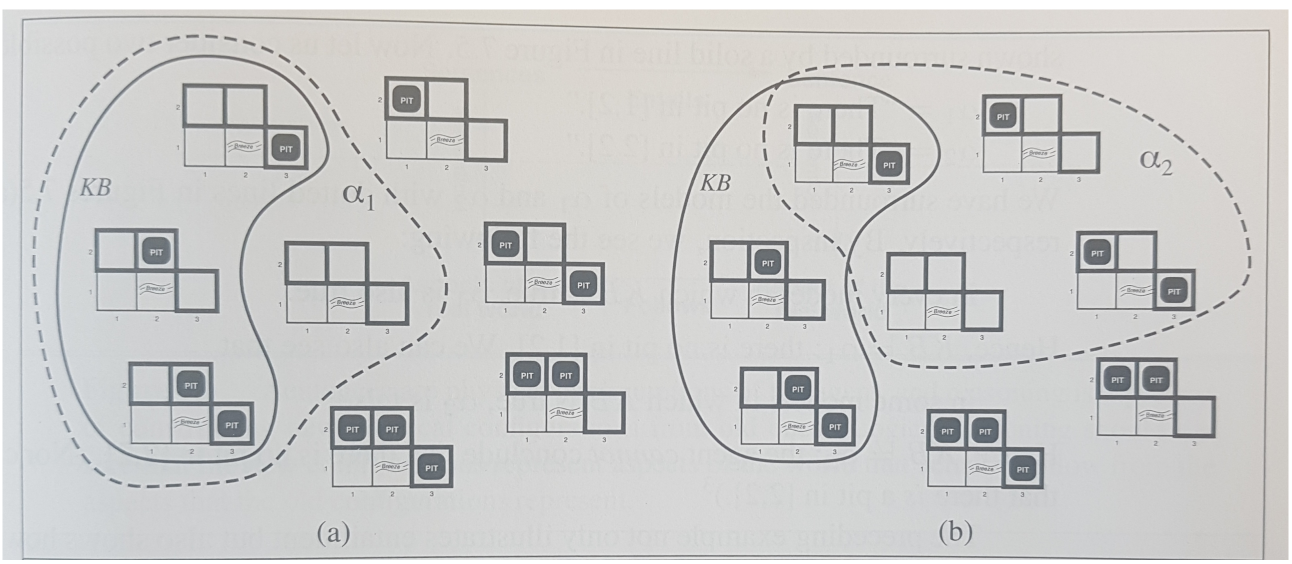

Figure 2: Question 3 - Possible models for the presence of pits in squares $[1,2]$, $[2,2]$, and $[3,1]$. The KB corresponding to the observations of nothing in $[1,1]$ and a breeze in $[2,1]$ is shown by the solid line. (a) Dotted line shows models of α_1(no pit in $[2,1]$). (b) Dotted line shows models of α_2(no pit in $[2,2]$)

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