CIT, DEPARTMENT OF COMPUTING

COMP9016 Lab #4

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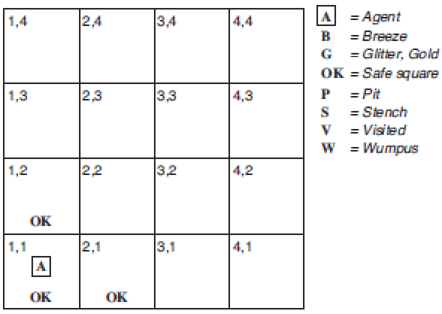
October 15, 2019

1 LOGIC

It is critical for the successful completion of the first assessment that you have a competent understanding of Propositional Logic, First-Order Logic and Inference in First-Order Logic. Launch your IDE, Jupyter Notebook. Navigate to and click on "logic.ipynb" - You are to review this notebook as it will provide you with a grounding in the practical implementation of logic using python.

1.1 PROPOSITIONAL LOGIC



(a)

- Suppose the agent has progressed to the point shown in Figure 7.4(a), page 239, having perceived nothing in [1,1], a breeze in [2,1], and a stench in [1,2], 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 7.5, 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]."
  - Hence show that KB $\models \alpha 2$ and KB $\models \alpha 3$.

- Which of the following are correct?

  a. $False \models True$.

  b. $True \models False$.

  c. $(A \wedge B) \models (A \leftrightarrow B)$.

  d. $A \leftrightarrow B \models A \vee B$.

  e. $A \leftrightarrow B \models \neg A \vee B$.

  f. $(A \wedge B) \implies C \models (A \implies C) \vee (B \implies C)$.

  g. $(C \vee (\neg A \wedge \neg B)) \equiv ((A \implies C) \wedge (B \implies C))$.

  h. $(A \vee B) \wedge (\neg C \vee \neg D \vee E) \implies (A \vee B)$.

  i. $(A \vee B) \wedge (\neg C \vee \neg D \vee E) \models (A \vee B) \wedge (\neg D \vee E)$.

  j. $(A \vee B) \wedge \neg(A \implies B) is satisfiable$.

  k. $(A \leftrightarrow B) \wedge (\neg A \vee B) is satisfiable$.

  l. $(A \leftrightarrow B) \leftrightarrow C$ has the same number of models as $(A \leftrightarrow B)$ for any fixed set of proposition symbols that includes A, B, C.

- Prove each of the following assertions:

  a. α is valid if and only if True $\models \alpha$.

  b. For any α, False $\models \alpha$.

  c. $\alpha \models \beta$ if and only if the sentence $(\alpha \implies \beta)$ is valid.

  d. $\alpha \equiv \beta$ if and only if the sentence $(\alpha \Leftrightarrow \beta)$ is valid.

  e. $\alpha \models \beta$ if and only if the sentence $(\alpha \wedge \neg \beta)$ is unsatisfiable.

1.2 Review

Congrats on having completed your lab on logic, this is a necessary topic for pursuing some of our later work as part of COMP9016!