Unit 2 – Logical Reasoning

Proportional Logic – Part – II
A simple knowledge Base (KB)

Propositional Logic

- Syntax and Semantic

- Atomic Sentences

- Complex Sentences

- Logical Connectives

- Truth Table For Logical Connectives

- A Simple knowledge Base (KB) • Inferences

- Equivalence, validity, and satisfiability

- Reasoning Patterns in Propositional Logic

A Simple Knowledge Base
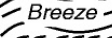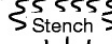
- We have defined the semantics for propositional logic, we can construct a knowledge base for the Wumpus world

- Let Pi,j be true if there is a Pit in [i, j].

- Let Bi,j be true if there is a Breeze in [i, j].

- The knowledge base includes the following sentences, each one labeled for convenience:

- There is no Pit in [1, 1]:

  $R1: \neg P_{1,1}$.

- A square is Breezy if and only if there is a Pit in a neighboring

square

  $R_2: B_{1,1} \Leftrightarrow (P_{1,2} \lor P_{2,1})$.

  $R_3: B_{2,1} \Leftrightarrow (P_{1,1} \lor P_{2,2} \lor P_{3,1})$.

A Simple Knowledge Base...

- The preceding sentences are true in all Wumpus worlds.

    R_4: ¬$B_{1,1}$.

    R_5: $B_{2,1}$

- The knowledge base consists of sentences R1 through R5

- It can also be considered as a single sentence -

- The conjunction R1 ∧ R2 ∧ R3 ∧ R4 ∧ R5-

- because it asserts that all the individual sentences are true.

$B_{1,1}$	$B_{2,1}$	$P_{1,1}$	$P_{1,2}$	$P_{2,1}$	$P_{2,2}$	$P_{3,1}$	R_1	R_2	R_3	R_4	R_5	KB
false	false	false	false	false	false	false	true	true	true	true	false	false
false	false	false	false	false	false	true	true	true	false	true	false	false
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
false	true	false	false	false	false	false	true	true	false	true	true	false
false	true	false	false	false	false	true	true	true	true	true	true	true
false	true	false	false	false	true	false	true	true	true	true	true	true
false	true	false	false	false	true	true	true	true	true	true	true	true
false	true	false	false	true	false	false	true	false	false	true	true	false
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
true	true	true	true	true	true	true	false	true	true	false	true	false

•A Truth Table constructed for the knowledge base given in the text

•KB is true if R1 through R5 are true, (R1 ∧ R2 ∧ R3 ∧ R4 ∧ R5)

•Which occurs in just 3 of the 128 rows

Sound and Complete

- Sound

  - Yes, because the inference rules themselves are sound. (This can be proven using a truth table argument).

- Complete

  - Yes, If we allow all possible inference rules (because the rules are limited), we're searching in a finite state space, hence complete.

  - If we limit/reduce inference rules, we run the risk of (sometimes) leaving out the necessary one... (hence not complete)