SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-35
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ARTIFICIAL INTELLIGENCE FOR ELECTRICAL ENGINEERING
UNIT 2

TOPIC:Propositional logic

TOPIC OUTLINE

Introduction to KBA
Logic: A General Idea
The Wumpus World Problem
Propositional Logic

Syntax

- Defines the allowable sentences
- **Atomic sentence** $\longrightarrow$ Contains a **single proposition symbol,** that can be true/false
- Convention- start with uppercase- $P, Q, R, W_{1,3}$ and $North$
- Symbols with fixed meanings: $True$ is the always-true proposition and $False$ is the always-false proposition
- **Complex sentences** are constructed from **simpler sentences**, using parentheses and logical connectives

Logical connectives(1/2)

- $\neg$ (not) A sentence such as $\neg P$ is called the negation of P. A literal is either an atomic sentence (a positive literal) or a negated atomic sentence (a negative literal)
- $\wedge$ (and) A sentence whose main connective is $\wedge$, such as $P \wedge Q$ is called a conjunction; its parts are the conjuncts
- $\vee$ (or) A sentence using $\vee$, such as $(P \wedge Q) \vee R$, is a disjunction of the disjuncts $P \wedge Q$ and R

Logical connectives(2/2)

$\Rightarrow$ (implies). A sentence such as $(P \wedge Q) \Rightarrow \neg R$ is called an implication (or conditional). Its premise or antecedent is $(P \wedge Q)$, and its conclusion or consequent is $\neg R$. Implications are also known as rules or if–then statements

$\Leftrightarrow$ (if and only if). The sentence $P \Leftrightarrow \neg Q$ is a biconditional

Sentence	→	*AtomicSentence* | *ComplexSentence*
AtomicSentence	→	*True* | *False* | *P* | *Q* | *R* | ...
ComplexSentence	→	(*Sentence*) | [*Sentence*]
	|	¬ *Sentence*
	|	*Sentence* ∧ *Sentence*
	|	*Sentence* ∨ *Sentence*
	|	*Sentence* ⇒ *Sentence*
	|	*Sentence* ⇔ *Sentence*
OPERATOR PRECEDENCE	:	¬, ∧, ∨, ⇒, ⇔

Semantics

- Defines the rules for determining the truth of a sentence with respect to a particular model
- Semantics for propositional logic must specify how to compute the truth value of any sentence, given a model
- For simple sentences:
  - $True$ is true in every model and $False$ is false in every model
  - The truth value of every other proposition symbol must be specified directly in the model
- For complex sentences, follow the five rules (m is model and "iff" means "if and only if"):
  1. $\neg P$ is true iff P is false in m
  2. $P \wedge Q$ is true iff both P and Q are true in m
  3. $P \vee Q$ is true iff either P or Q is true in m
  4. $P \Rightarrow Q$ is true unless P is true and Q is false in m
  5. $P \Leftrightarrow Q$ is true iff P and Q are both true or both false in m

Truth Tables

- Specify the truth value of a complex sentence for each possible assignment of truth values to its components

P	Q	$\neg P$	$P \wedge Q$	$P \vee Q$	$P \Rightarrow Q$	$P \Leftrightarrow Q$
false	*false*	*true*	*false*	*false*	*true*	*true*
false	*true*	*true*	*false*	*true*	*true*	*false*
true	*false*	*false*	*false*	*true*	*false*	*false*
true	*true*	*false*	*true*	*true*	*true*	*true*


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