SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107

Accredited by NAAC-UGC with 'A' Grade

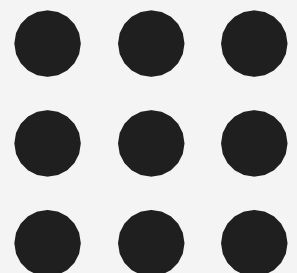Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai

Department of Information Technology
Course Name – Software Engineering

II Year / III Semester

Unit-3 Reasoning Under Uncertainity

- Introduction to reasoning under uncertainty
- Review of probability
  - Axioms and inference
  - Conditional probability
  - Probability distributions

Uncertainty
- Back to planning:
- Let action A(t) denote leaving for the airport t minutes before the flight
  - For a given value of t, will A(t) get me there on time?
- Problems:
- Partial observability (roads, other drivers' plans, etc.)
  - Noisy sensors (traffic reports)
  - Uncertainty in action outcomes (flat tire, etc.) – Immense complexity of modeling and predicting traffic

Methods for Handling Uncertainty

• Default (non-monotonic) logic: make assumptions unless contradicted by evidence.

– E.g. "Assume my car doesnt have a flat tire.

What assumptions are reasonable? What about contradictions?

• Rules with fudge factor:

– E.g. "Sprinkler →0.99 WetGrass", "WetGrass →0.7 Rain"

But: Problems with combination (e.g. Sprinkler causes rain?)

• Probability:

– E.g. Given what I know, A(25) succeed with probability 0.2

• Fuzzy logic:

– E.g. WetGrass is true to degree 0.2 But: Handles degree of truth, NOT uncertainty.

Probability

- A well-known and well-understood framework for dealing with uncertainty
- Has a clear semantics
- Provides principled answers for: – Combining evidence – Predictive and diagnostic reasoning – Incorporation of new evidence
- Can be learned from data
- Intuitive to human experts (arguably?)

Why Not Use First-Order Logic?

• A purely logical approach has two main problems:
– Risks falsehood
   ∗ A(25) will get me there on time.
– Leads to conclusions that are too weak:
   ∗ A(25) will get me there on time if there is no accident on the bridge and it does not rain and my tires remain intact, etc. etc.
   ∗ A(1440) might reasonably be said to get me there on time (but I would have to stay over night at the airport!)