

# Uncertainty

## Chapter 13

### Outline

- Uncertainty
- Probability
- Syntax and Semantics
- Inference
- Independence and Bayes' Rule

# Uncertainty

Let action  $A_t$  = leave for airport  $t$  minutes before flight  
Will  $A_t$  get me there on time?

Problems:

1. partial observability (road state, other drivers' plans, etc.)
2. noisy sensors (traffic reports)
3. uncertainty in action outcomes (flat tire, etc.)
4. immense complexity of modeling and predicting traffic

Hence a purely logical approach either

1. risks falsehood: " $A_{25}$  will get me there on time", or
2. leads to conclusions that are too weak for decision making:

" $A_{25}$  will get me there on time if there's no accident on the bridge and it doesn't rain and my tires remain intact etc etc."

( $A_{1440}$  might reasonably be said to get me there on time but I'd have to stay overnight in the airport ...)

## But...

- A decision must be made!
- No intelligent system can afford to consider all eventualities, wait until all the data is in and complete, or try all possibilities to see what happens

## Quick Overview of Reasoning Systems

- Logic: True or false, nothing in between. No uncertainty
- Non-monotonic logic: True or false, but new information can change it.
- Probability: Degree of belief, but in the end it's either true or false
- Fuzzy: Degree of belief, allows overlapping of true and false states

## Examples

- Logic: All birds fly
- Non-monotonic
  - Tweety flies, since he's a bird and no evidence he doesn't fly