Data and Knowledge Representation
Lecture 6
Last Time We Talked About

- Major KR schemes
  - Semantic Network
  - Frame-based Representation
  - Production Rules
Today We Will Talk About

- Process
  - Finite state machine
  - Flow chart
  - Petri Net
Process

- **Object: continuant**
  - E.g. diagnosis, medication, data repository

- **Process: occurrent**
  - E.g. diagnose, treat, retrieve
Describing Process

- Predicate logic
  - treat (Dr. Jones, Ms. List)
- Frame-based system
  - Patient Frame has a slot “primary care” or “attending physician”
- There are more about “treat” to specify
  - When, where, how, why, what result
Types of Process

- Continuous Process
  - Initiation
  - Continuation

- Discrete Process
  - Event
  - State

- Cessation

Process
Example

- Continuous Process
  - Aging
- Discrete Process
  - Outpatient visit (make appointment, check in with nurse, see a doctor, have test/receive medication)
Basic Distinctions

- Discrete or continuous
- Linear or branching
- Independent or ramified
- Immediate or delayed
- Sequential or concurrent
- Predictable or surprising
Basic Distinctions

- Normal or equinomral
- Flat or hierarchical
- Timeless or time-bound
- Forgetful or memory-bound
Process, Procedure and History

- Sequence of events and state
- Process: one event or state is current
- Procedure: abstract (pattern or script of processes)
- History: record of a past process
Finite State Machine (FSM)

- Discrete process (continuous process can be simulated with fine time steps)
- State transition diagram
- Formal Definition:
  - A finite set of states: $Q$
  - A finite set of inputs: $I$
  - A transition function $F(Q, I) \rightarrow Q$, $F$ can be a partial Function
FSM

- Basic components: state (circle), transition (arrow), input (label on the arrow)
- End state can be marked with double circles
FSM

normal blood sugar in test 1

Suspect DB

No DB

normal blood sugar in test 2

Confirmed DB

High blood sugar in test 1

Highly suspect DB

High blood sugar in test 2
Flow Chart

- Event (box) and decision (diamond)
- Arrow (transition) and label on the arrow (condition for decision)
- Start and end can be specified with box
Petri Net

- A finite set of places (circle)
- A finite set of transactions (line)
- A finite set of arrows connecting either places to transactions or transactions to places
Petri Net

- **Marking**: assign a non-negative integer to each place. (dot/token)
- **Firing**: a transaction take place after enabled
- **Firing sequence**: the sequence of transaction firings for a given PN with a given initial marking
Petri Net

- Conflict
- Starvation
- Deadlock
Petri Net

- Assign values to tokens
- Define functions for transaction
- Specify scheduling policies
- Times Petri Net
Exercise

Overweight patients should be instructed either to excise regularly or to keep a healthy diet for 3 months. When one fails, try both for 3 months. When both fail, a patient should be given medication x for 2 months.
Reading

- Sowa Chap. 3