Today’s Lecture

• Introduce the Petri Net Formalism
  – Present several examples

Petri Nets

• Formal Definition

\[ N = \{ P, T, A, M_0 \}, \text{ where} \]
\[ P \text{ is a finite set of places} \]
\[ T \text{ is a finite set of transitions} \]
\[ A \text{ is a finite set of arcs (arrows)} \]
\[ M_0 \text{ is the initial marking of } N \]
Graphical Representation

Petri Nets

- Intuitive Meaning
  - A place holds tokens
  - A transition represents activity
  - An arc connects a place and a transition
  - A marking is an arrangement of tokens in places, representing state
  - An initial marking represents an initial state

Execution Model

- Input and Output Places
  - Place $P$ is an input place for transition $T$ if there is an arc from $P$ to $T$
  - Place $P$ is an output place for transition $T$ if there is an arc from $T$ to $P$

- Enabled Transition
  - A transition is enabled if there is at least one token at each of its input places

Petri Net Semaphore
Execution Model

• Firing a Transition
  – An enabled transition is nondeterministically selected and fired by removing one token from each of its input places and depositing one token at each of its output places

• Firing Sequence
  – A firing sequence is a sequence $<t_0, t_1, \ldots, t_n>$ such that $t_0$ is enabled and fired in $M_0$, $t_1$ is enabled and fired in $M_1$, etc.
Breaking the Semaphore

• Lets look at the semaphore example again and see how a change to the initial marking will change the semantics of the Petri Net
  – In particular, we will break the semantics of the semaphore by adding one token
Petri Net Semaphore

Enabled Transitions

After Firing

Enabled Transitions
Filling Station Example

- Lets model the following situation
  - Fuel Pumps
  - Spaces next to Pumps
  - A cashier that takes payment
- Questions
  - What is the concurrency that we want modeled?
  - How do we handle the parameterization of the Petri net? (e.g. lets say I want to add a pump)