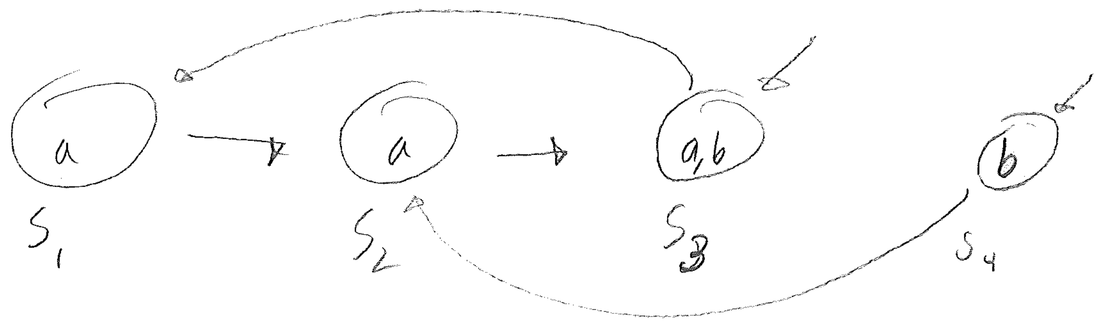
Joseph Blodgett
CS 486
HW 7

1)



- $Xa = \{s_1, s_2, s_3\}$
- $XXXa = \{s_1, s_2, s_3, s_4\}$
- $[]b = \{s_3, s_4\}$
- $[]<>a \{s_1, s_2, s_3, s_4\}$
- $[]b\,U\,a = \{s_4, s_3, s_1, s_2\}$
- $<>b\,U\,a = \{s_4, s_3, s_1, s_2\}$

2)

- Any door will not open unless the elevator is presen
  - $P = \{$door Open, elevator present $\}$
  - LtL = $[] \neg($doorOpen $\wedge \neg$ elevator present$)$
- Requested floor will be served eventually.
  - $P = \{$Requested, served$\}$

    LtL = $[] \neg($Requested $\wedge \neg E$ served$)$
- The elevator repeadetly returns to floor 0
  - $P = \{0\}$ ← Meaning Floor position

    LtL = $[]<>0$
- Topfloor is served immeditly
  - $P = \{$Rtop, Stop$\}$ (Requested, served) LtL = $[] \neg($Rtop $\wedge \neg X$ Stop$)$

3)

- Number of items in a buffer may not exceed N

  - Saftey

  - CTL* = $[\,]A\neg N+1$

  $P = \{1, 2, 3, \ldots, N, N+1\}$ ← current buffer count

- If a process reaches a location l_i just before a critical section, it should not be blocked forever

  $p = \{l_i, \text{critical}\}$

  - Liveness

  - CTL* = $[\,]A\neg(l_i \wedge \neg(\langle\rangle\, \text{critical}))$

- Clients may not retain resources forever

  $P = \{\text{obtain}, \text{release}\}$

  - Liveness

  - CTL* = $[\,]A\neg(\text{obtain} \wedge \neg(\langle\rangle\, \text{release}))$

- it is always cloudy before it rains

  - Saftey cloudy, Rain
  - $P = \{C, R\}$

  $[\,]A(\neg R\, U\, C)$

4) Transition !p to p will happen at most once

$([\,]\neg P)\,U([\,]P) \vee [\,]\neg P$

5) Infinately many transitions from !p to p.

$\neg(P \wedge \neg\langle\rangle\neg P) \wedge \neg(\neg P \wedge \neg\langle\rangle P)$

$P \to \langle\rangle\neg P \;\wedge\; \neg P \to \langle\rangle P$

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6) $((r \to r \mathcal{U} y) \wedge (y \to y \mathcal{U} g) \wedge (g \to g \mathcal{U} r))$

assuming $r \to y \to g \to r$ not $g \to y \to r \to g$

$!(r \wedge !r \mathcal{U} y) \wedge !(y \wedge !y \mathcal{U} g) \wedge !(g \wedge !g \mathcal{U} r)$

7) $q \to \neg p \mathcal{U} r$

$\Downarrow$

$!(q \mathcal{U} \neg(\neg p \mathcal{U} r))$