Solution of Assignment 1

2.1

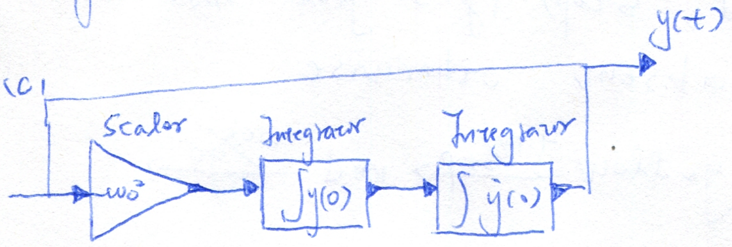
(a) No, $\ddot{y}(t) + \omega_0^2 y(t) = 0$

solve the second-order ODE, then the general solution is

$y(t) = C_1 e^{\omega_0 x} + C_2 e^{-\omega_0 x}$. By selecting different constant pair (C_1, C_2), we can get different solutions, such as $\alpha \cos \omega_0 t$, $\beta \sin \omega_0 t$. $\alpha, \beta \neq 0$.

(b) $y(0) = \cos(0 \cdot \omega_0) = 1$

(c)



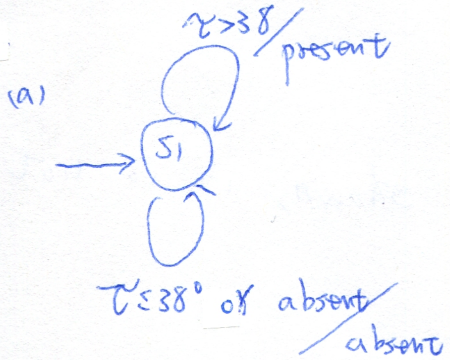
$\ddot{y}(t) = -\omega_0^2 y(t)$

$\dot{y}(t) = \dot{y}(0) - \omega_0^2 \int_0^t y(\tau)\, d\tau$

$y(t) = y(0) + t\dot{y}(0) - \omega_0^2 \int_0^t \int_0^\tau y(\theta)\, d\theta\, d\tau$

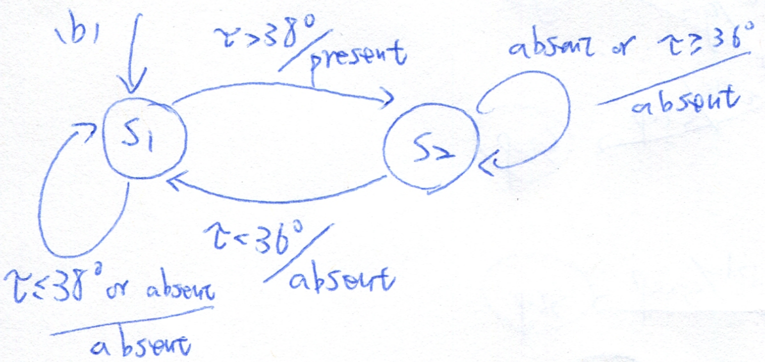
3.1

(a)



If you have other solutions, then you need a detail description to convince the grader.

(b)



Note that you need to cover the case that temperature τ equals 36 degree.

(c) Since the problem statement is ambiguous. Everybody gets points here.

3.3

(a)

States = $\{red, yellow, green\}$

Inputs = $(\{tick\} \longrightarrow \{present, absent\})$

Outputs = $(\{go, stop\} \longrightarrow \{present, absent\})$

Initial.State = $\{red\}$

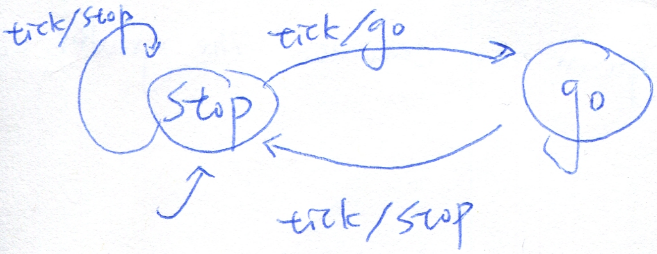
The update function is defined as

$$update(s, i) = \begin{cases} (green, go) & \text{if } s = red \text{ AND } i(tick) = present \\ (yellow, stop) & \text{if } s = green \text{ AND } i(tick) = present \\ (red, stop) & \text{if } s = yellow \text{ AND } i(tick) = present \\ (s, absent) & \text{otherwise} \end{cases}$$

(b)

$$red \xrightarrow{tick/go} green \xrightarrow{tick/stop} yellow \xrightarrow{tick/stop} red \xrightarrow{tick/go}$$

(c) The depth of the tree is 4.



As the FSM shown, it is not deterministic.