


ANSWER SHEET
CS 522, Embedded Systems
Midsem Exam, Monsoon 2023-24
Department of Computer Science and Engineering
IIT Guwahati

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Date: 24/09/23

Student's Signature: 

Invigilator's Signature: 

Examiner's Signature: _____

Do not write in this box.

Question:	1	2	3	4	5	Total
Marks:	20	10	10	10	10	60
Score:	20	8	10	8	8	54

Answers

Q1(a)

From Newton's law of motion,

$$u(t) - k_1 y(t) - k_2 \dot{y}(t) = m \ddot{y}(t)$$

$$\frac{1}{m} [u(t) - (k_1 + k_2) \dot{y}(t)] = \ddot{y}(t)$$

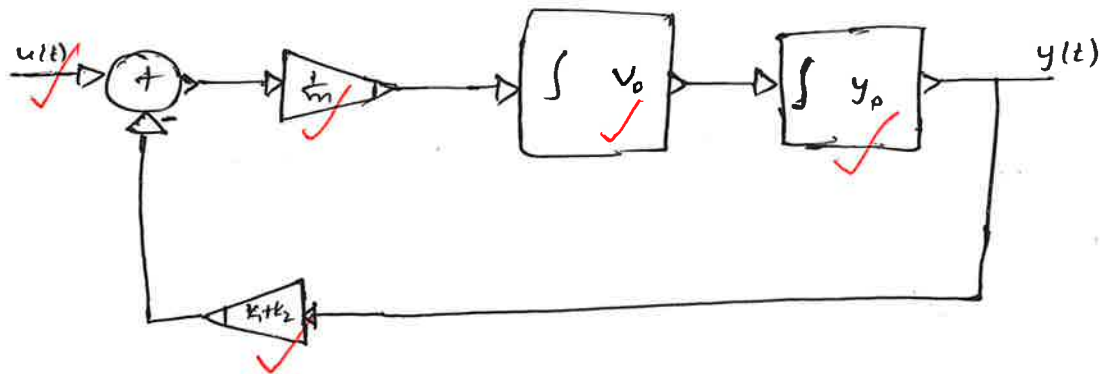
The state variables of this system is thus, $y(t)$ and $\dot{y}(t)$. So if $x(t)$ is a state vector then $x(t) = \begin{bmatrix} y(t) \\ \dot{y}(t) \end{bmatrix}$ ✓

$$\dot{x}(t) = \frac{d}{dt} x(t) = \begin{bmatrix} \dot{y}(t) \\ \ddot{y}(t) \end{bmatrix} = \begin{bmatrix} \dot{y}(t) \\ \frac{1}{m} [u(t) - (k_1 + k_2) \dot{y}(t)] \end{bmatrix} \quad \checkmark$$

$$\dot{x}(t) = \begin{bmatrix} 0 & 1 \\ -\frac{(k_1 + k_2)}{m} & 0 \end{bmatrix} \begin{bmatrix} y(t) \\ \dot{y}(t) \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{1}{m} \end{bmatrix} [u(t)]$$

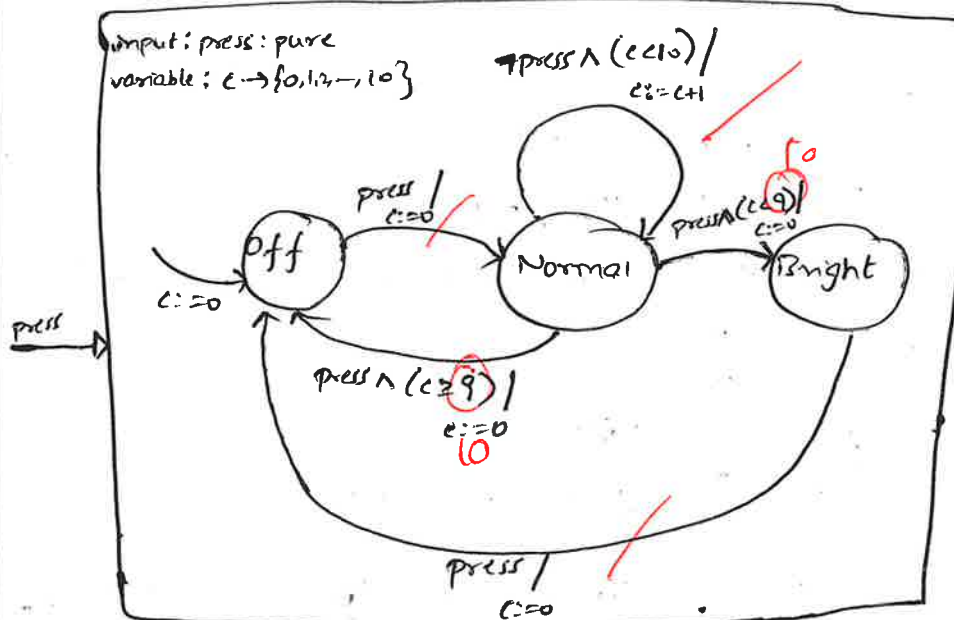
$\therefore \dot{x}(t) = F(x(t), u(t))$ where $F(x, u) = Ax + Bu$ where $A = \begin{bmatrix} 0 & 1 \\ -\frac{(k_1 + k_2)}{m} & 0 \end{bmatrix}$
and $B = \begin{bmatrix} 0 \\ \frac{1}{m} \end{bmatrix}$

Q1(b)

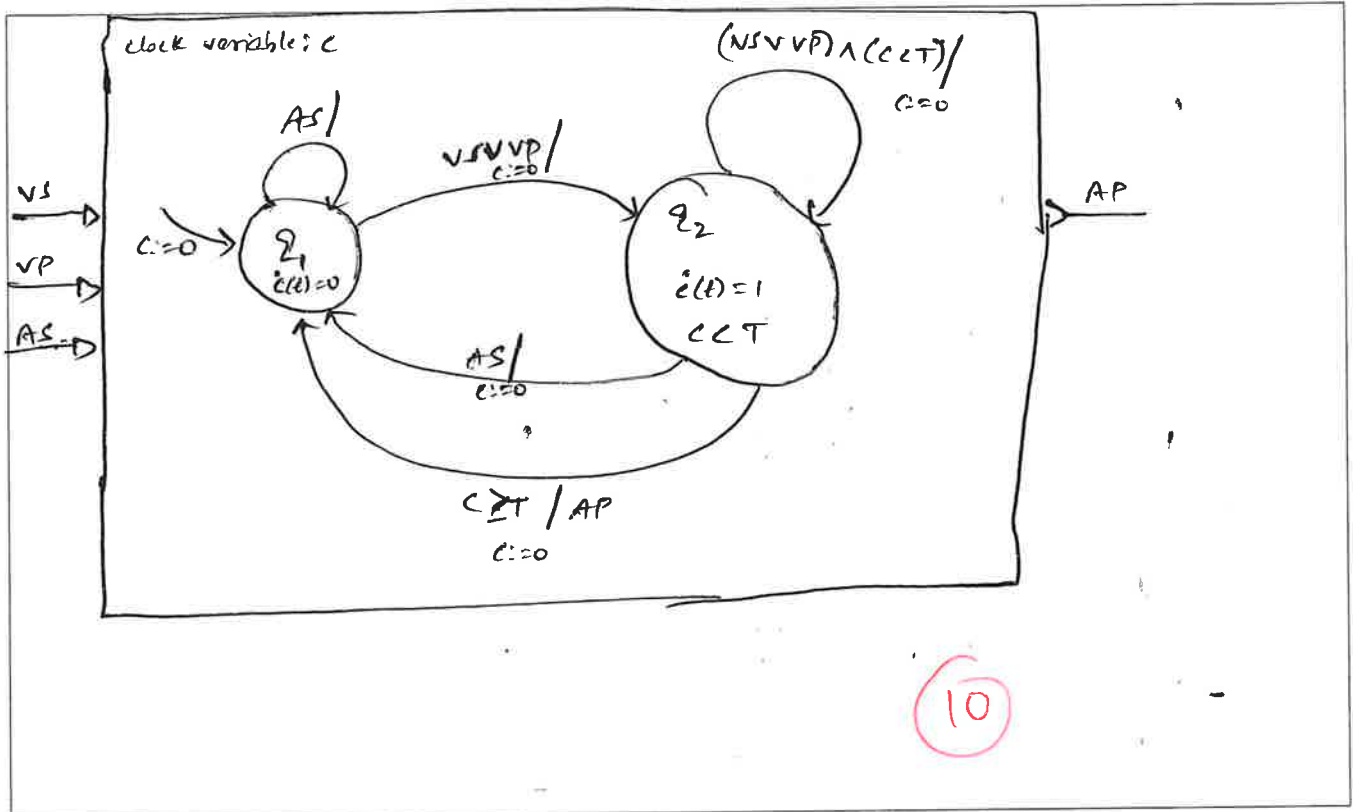


Actor Model of given system

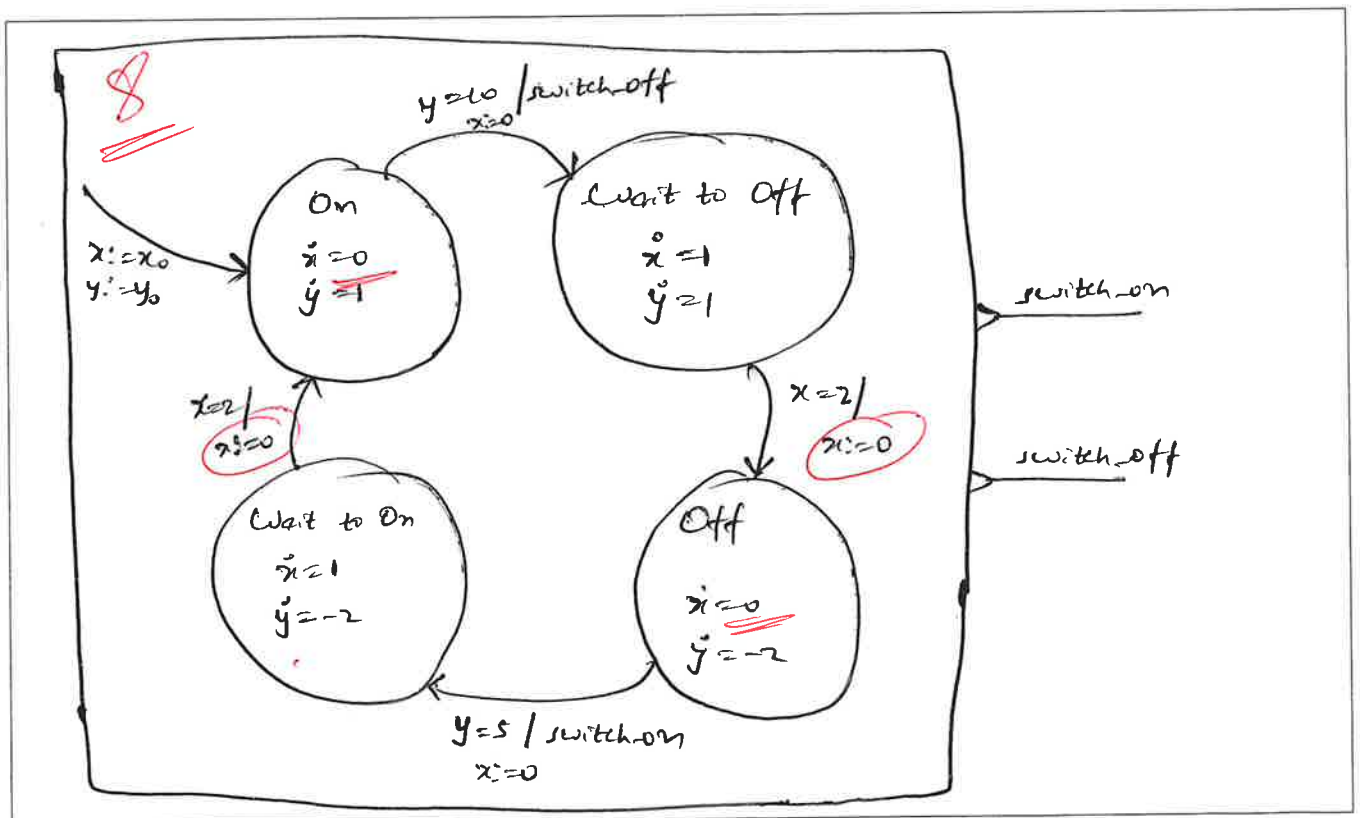
Q2



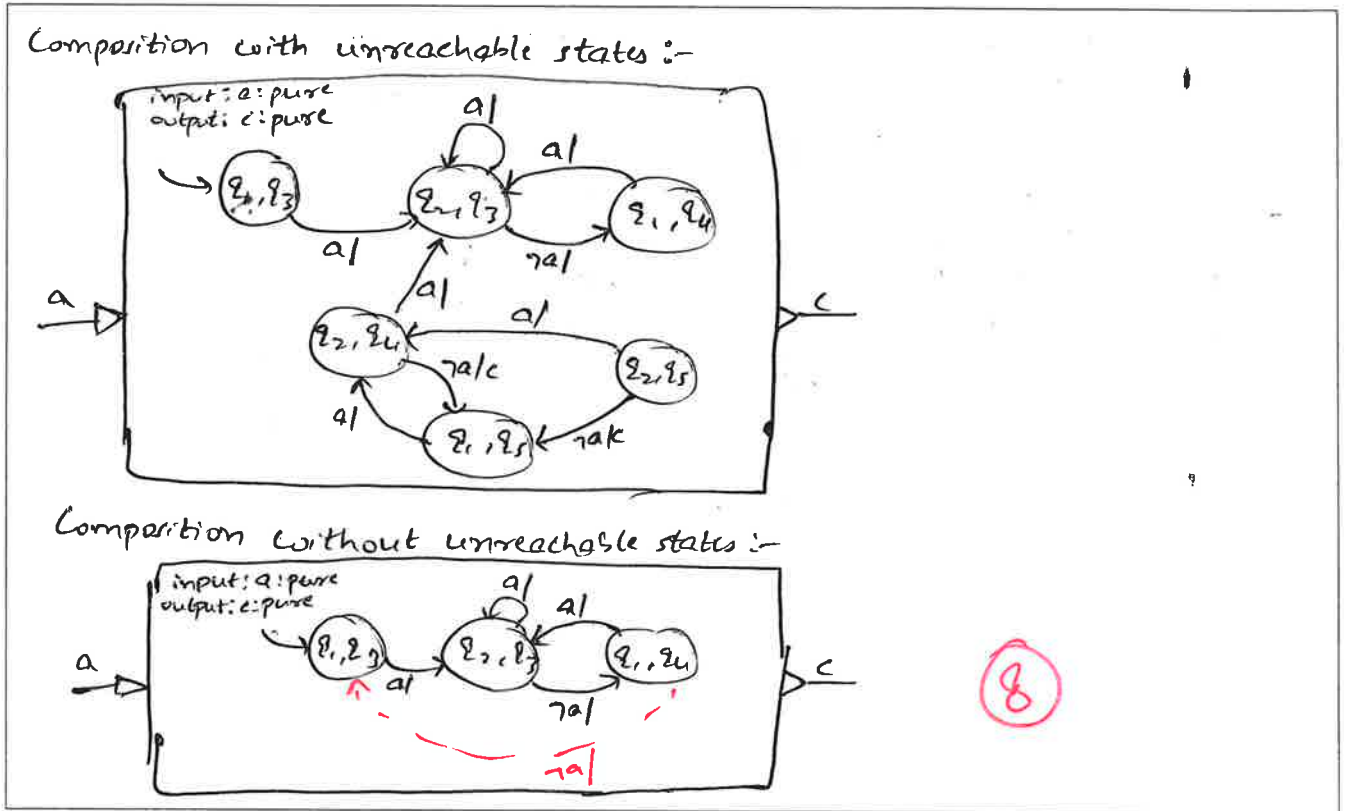
Q3



Q4



Q5



Important: Use the following boxes only if you cancel one of your earlier answers. Do not use these boxes for continuation of earlier answers. Mention the question number against the box you are using.

