K i n g S a u d U n i v e r s i t y
College of Computer and Information Sciences
Computer Science Department

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Course Code:	CSC 339
Course Title:	Theory of Computation
Semester:	2nd (1443)
Exercises Cover Sheet:	Homework#1
Due-Date :	**Thursday 21 April 11:59**

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Name		**ID**	

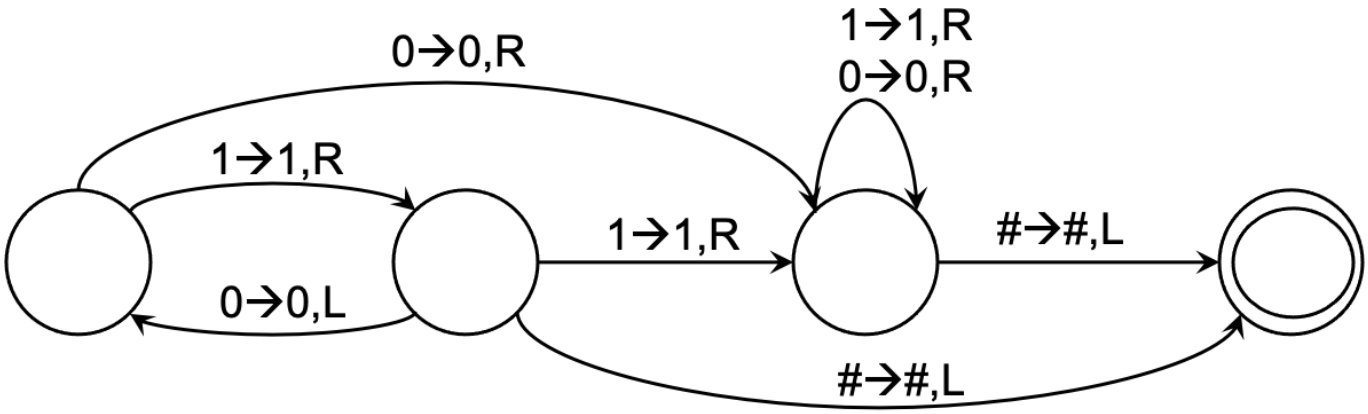
Course Learning Outcomes		**Relevant Question No**	**Full Mark**	**Student Mark**
CLO 1	Identify regular and non-regular languages (K1)			
CLO 2	Identify decidable and non-decidable, NP-complete, and reducible problems (K1)			
CLO 3	Produce computing-based solutions using regular expressions, and context free grammar (K2)			
CLO 4	Design different machine models (DFA, NFA, PDA, TM) (S1)	**Part 1**	**5**	
CLO 5	Evaluate the language accepted by a machine, a regular expression, and a context free grammar (S1)	**Part 2**	**2**	
CLO 6	Evaluate the time and space complexity of a Turing machine (S1)	**Part 3**	**3**	

Question 1

- Design a Turing machine with input alphabet $\boldsymbol{\Sigma} = \{\mathbf{0}, \mathbf{1}\}$ that accepts the language $\boldsymbol{L} = \{\mathbf{0}^{\boldsymbol{i}}\mathbf{1}^{\mathbf{2}\boldsymbol{i}} \mid \boldsymbol{i} \geq \mathbf{0}\}$.
- Design a deterministic Turing machine with input alphabet $\boldsymbol{\Sigma} = \{\boldsymbol{a}, \boldsymbol{b}, \$\}$ that accepts the language $\boldsymbol{L} = \{\mathbf{w\$w \mid w} \in \mathbf{\{a,b\}^*}\}$.
- Construct a Turing machine that computes f (n) = 3n where integers are represented in unary notation

Question 2

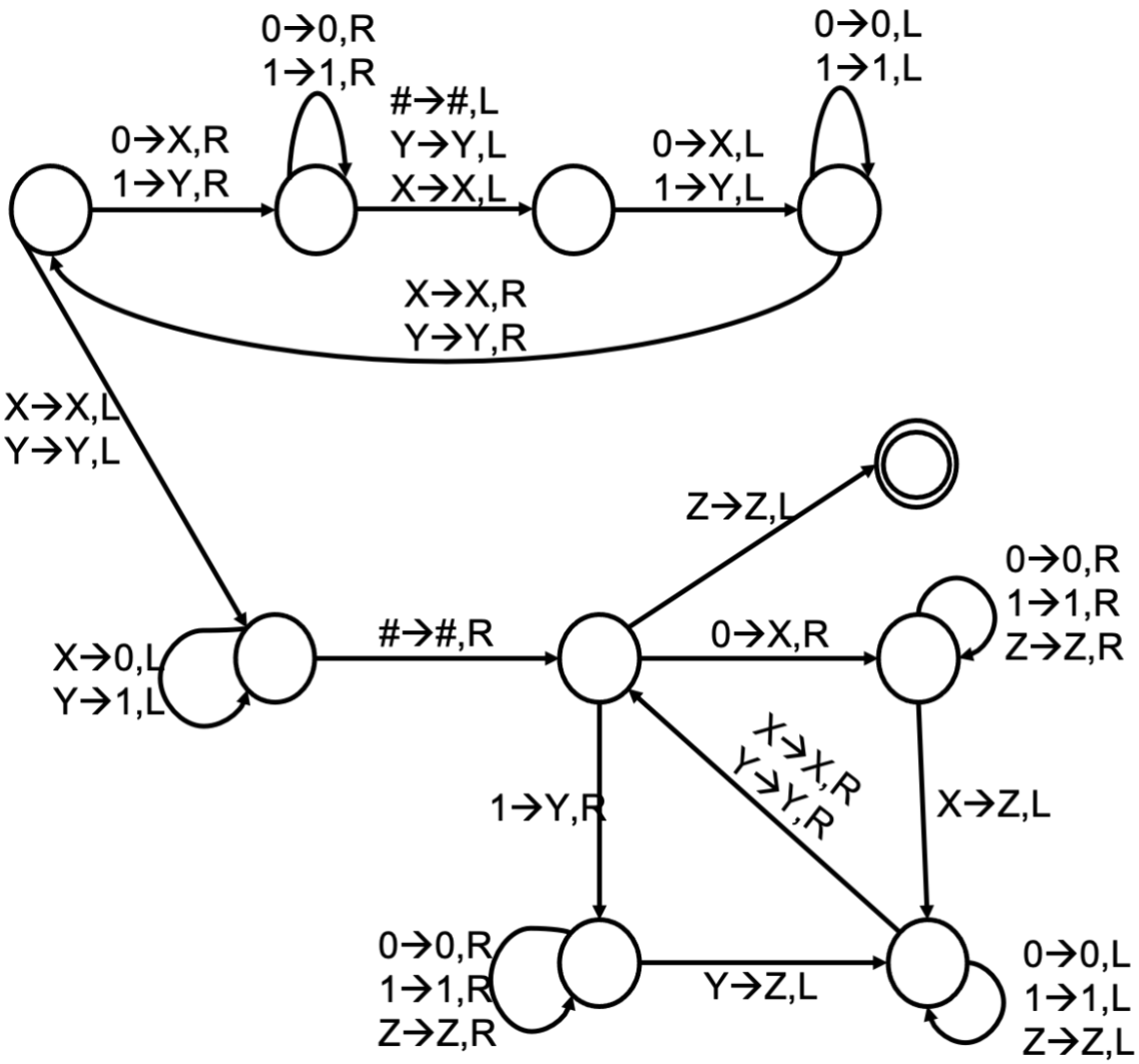
1. Given the Turing machine M with input alphabet {0, 1} in Figure 1 answer the following question



- Trace the computation for the input string $\mathbf{110}$.
- Trace the computation for the input string $\mathbf{101}$.
- what is the language accepted by M?
- Which statement is correct?
  A. M halts on all inputs
  B. M never halts on some inputs
  C. M does not halt on any input
  D. None
- The machine M is decidable:
  A. True
  B. False

Question 3

1. Given the Turing machine M with input alphabet {0, 1} in Figure 1, **give**



- Trace the computation for the input string $\mathbf{1010}$.
- Accepted language
- The time complexity and its corresponding class
- The space complexity and its corresponding class