Homework Assignment-2

King Saud University	Name: ……
CSC-339 Theory of Computation	KSU ID: ……
Spring semester 2021	Section number: ……

Due date: Sunday April 18th, 2021 at 11:55 pm

Instructions

1. The solution to this assignment should be your own work. Collaboration of any kind is prohibited.
2. Use this file to write your answers, and after completing the assignment, submit your solution as a PDF file.
3. You may type (using a keyboard) or write (by hand) your answers. In case you choose to write your answer, please make sure your handwriting is clear.
4. Plagiarism of any kind will result in a zero mark for the whole assignment.

Question-1

Design a **Turing Machine (M_1)** that takes any string as input (except the empty string), and shifts each character of the string one place into the right. For instance, if the tape initially contains the following [$a|b|a|\sqcup|\sqcup$], then it should contain the following after $\mathbf{M_1}$ halts [$\#|a|b|a|\sqcup$]. You may assume that $\mathbf{M_1}$ always halts and accepts except when the tape does not contain anything.

Assume the input alphabet Σ is {a, b} and the tape alphabet Γ is $\Sigma \cup$ {#, a, b, $\sqcup$}.

a) *(30 points)* Draw the state diagram for $\mathbf{M_1}$.

b) *(20 points)* Provide the formal definition for $\mathbf{M_1}$.

c) *(25 points)* Describe what $\mathbf{M_1}$ does in numbered stages (as an algorithm).

d) *(25 points)* Modify $\mathbf{M_1}$ to make it shift the tape content by two characters instead of one (e.g., the tape content in the previous example should be [#|#|a|b|a|␣]). Redraw the new version of $\mathbf{M_1}$.