United International University
Department of Computer Science and Engineering

CSE 2233: Theory of Computation Mid: Spring 2025

Total Marks: 30 Time: 1 hour and 30 minutes

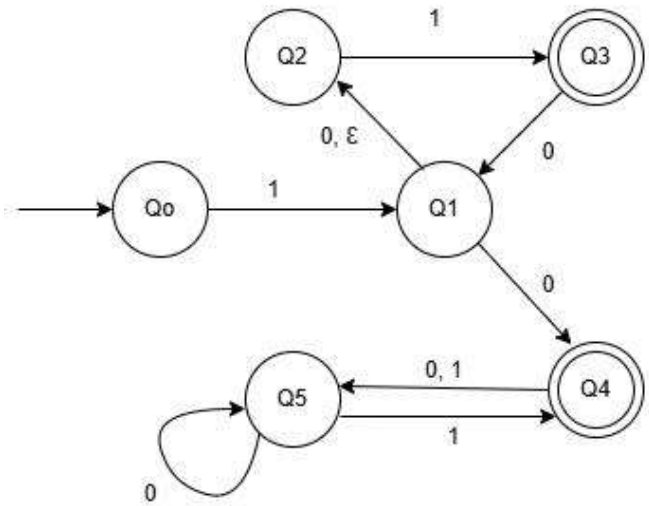
Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.

Answer all the questions. The numbers on the right of the questions denote their marks.

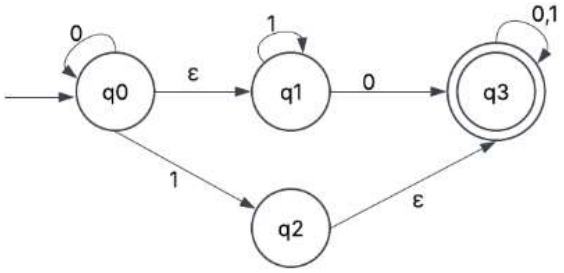
1. Design DFAs that accept the following languages:
   (a) L = {w | every w starts with even number of 'a' and ends with even number of 'b'}, $\sum$ = {a,b} (3)
   (b) L = {w | every w starts with 'aab' and contains 'bab' and ends with 'aa'}, $\sum$ = {a,b} (3)
   (c) L = {w | every w is made of only one type of alphabet}, $\sum$ = {a,b,c} (3)

2. Design NFAs that accept the following languages:
   (a) L = { w | w does not start with "a", contains "bbc" and ends with "ac" }, $\sum$ = {a, b, c} (3)
   (b) L = { w | w starts with "yz" or "xz", contains "yzx" or "xyz" and ends with "zzy" }, $\sum$ = {x, y, z} (3)
   (c) L = { $a^i b^j$ | where i is an odd number and j is an even number}, $\sum$ = {a, b} (3)

3. (a) Consider the following ε-NFA, and show with the help of NFA-tree whether the string **"110011"** is accepted or not. (3)



4. (a) Convert the following ε-NFA over alphabet $\sum$ = {0,1} to an equivalent DFA. Show both transition table and state diagram of the DFA. (6)



5. Design **Regular Expression** for the following languages:
   (a) L = {w | w starts with abc, contains bac, and ends with bab over the alphabet {a, b, c}} (1)
   (b) L = {w | w has even number of 0's over the alphabet {0, 1, 2}} (1)
   (c) L = {w | w starts with ab and has even length or w ends with cd and has odd length over the alphabet {a, b, c, d}} (1)