United International University
Department of Computer Science and Engineering

CSI 233: Theory of Computing

Mid Term Examination Set: A Time: 1 Hour 45 Minutes

1. (a) Construct a DFA over alphabet $\{0, 1\}$ that accepts the set of strings with odd number of 0's **and** even number of 1's. Show transition table for this DFA. [2+2]

   (b) Draw the state diagram of a DFA over alphabet $\{a, b, c, \ldots, z\}$ that accepts all strings that **does not** contain the word **"fear"** [2]

2. (a) Construct a Non-Deterministic Finite Automaton M = (Q, Σ, δ, q_0 , F), which recognizes the language defined by the regular expression: $0(010)^*$ [3]

   (b) UIU is giving job opportunities to students who have CGPA more than 3.50. Students who have CGPA more than 3.50 had to submit a form where they have given information about their phone number, birth date, email etc. As many candidates have applied for this post, UIU has decided to select students with CGPA more than 3.75 **and** aged below 25 on 01-01-2018 for the job. So, you have to write down regular expression for CGPA and birth date maintaining the condition that only qualified students get the job. You can safely assume that no one aged more than 100 years is currently studying at UIU. [3]
   Example :
   CGPA : 3.83 and birth date : 01-01-1993 (Selected)
   CGPA : 3.85 and birth date : 31-12-1992 (Rejected)

3. (a) Draw the **state diagram** of an NFA or ε-NFA that accepts all binary strings which start with 1 **or** end with 001 [2]

   (b) Draw the state diagram for alphabet set $\{0, 1, 2, \ldots, 9\}$ of an NFA or ε-NFA that accepts strings that ends with the digit (5), that is the summation of the first two digits. [2]

   (c) Draw the **state diagram** of an NFA or ε-NFA for the language $\{ w \in \Sigma^* \mid w$ contains at least two 0s **or** exactly two 1s$\}$ [2]

4. (a) Write down the **ε-closure** of the following ε-NFA of Figure 1 [2]

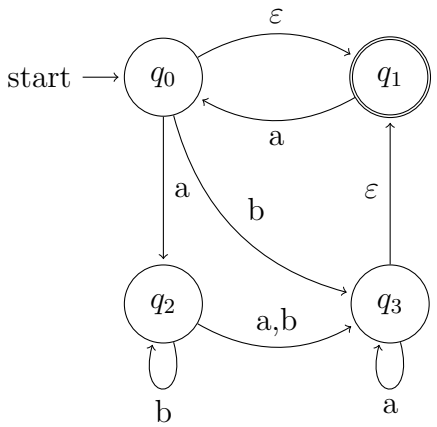

Figure 1: ε-NFA

   (b) Write down the **transition table** for the equivalent **DFA** for the above ε-NFA of Figure 1 [2]

(c) Draw the **state diagram** of the converted DFA [2]

5. (a) The strings that a regular language accepts are as follows: $\{ \varepsilon, a, b, aa, bb, aaa, bbb, aaaa, bbbb, aaaaa, bbbbb, \ldots, a^n, b^n, \ldots \}$ [2]
Now write a **Regular Expression** for this language.

(b) Suppose $\Sigma = \{0, 10, 111\}$, Write down the value of Σ^2 [2]

(c) Write down whether the following strings match the following Regular Expression [2]
$(((00)^*(10^+ \cup 1)) \cup 01)^*$
(i) 00100 (ii) 1010101 (iii) 0000100000 (iv) 0