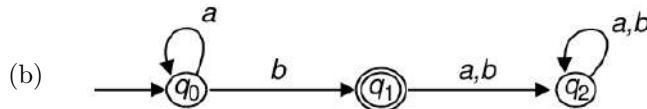




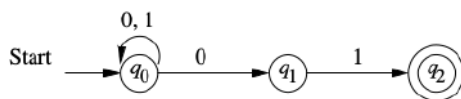
Answer all the 5 questions. Numbers to the right of the questions denote their marks.

1. (a) Given $\Sigma = \{a, b\}$, construct a DFA which recognizes the language $L = \{a^m b^n : m, n > 0\}$
Show the state diagram and transition table of the DFA. [2+2]



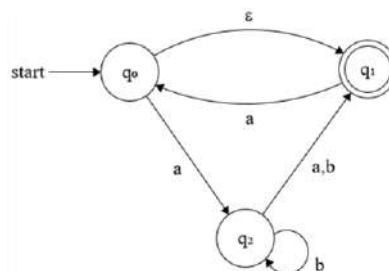
What the the language of the DFA? Give examples of 4 strings that are accepted by the DFA. [2]

2. (a) Based on the given NFA compute $\hat{\delta}$ for the given string, 00101: [3.5]



Here, $\hat{\delta}$ is the extended transition function of the NFA. First 2 steps are done for you.

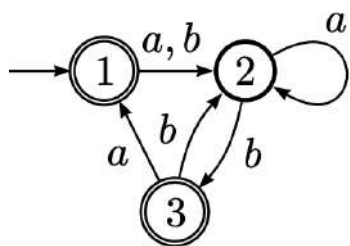
- i. $\hat{\delta}\{q_0, \epsilon\} = \{q_0\}$
ii. $\hat{\delta}\{q_0, 0\} = \{q_0, q_1\}$
- (b) UIU wants to motivate the students by giving prizes to those who have scored 3.80 GPA or more in the previous trimester. After filtering out the students based on this criteria, it is found that more than 20 students are in the list. But the authority is strict in giving prizes to exactly 20 students. After doing some experimentation, it is observed that exactly 20 students have odd digits after the decimal point of their GPA's. Now draw an NFA based on the condition that if a student has GPA more or equal to 3.80 and there are two odd digits (i.e 1,3,5,7,9) after the decimal point of their GPA's, then they will be awarded by UIU. [2.5]
3. (a) Write a regular expression over the alphabet $\Sigma = \{a, b\}$ for the following languages: [2+2]
i. $\{w \mid w \text{ neither contain two consecutive } a\text{'s nor two consecutive } b\text{'s}\}$
ii. $\{w \mid w \text{ is any string except } bb \text{ and } bbb\}$
- (b) Draw the state diagram of an NFA / ϵ -NFA which accepts all binary strings that have odd values.
Here, $\Sigma = \{0, 1\}$ [2]
4. Consider the following ϵ -NFA:



- (a) Compute the ϵ -closure of each state. [2]
(b) Convert the ϵ -NFA to equivalent DFA. Show both transition table and state diagram of the DFA. [4]

5. (a) Convert the following DFA to an equivalent regular expression

[4]



- (b) Write regular expressions for the following languages.

[2]

- i. $\{w \mid w \text{ contains a single } 1\}$
- ii. $\{w \mid \text{the length of } w \text{ is a multiple of } 4\}$