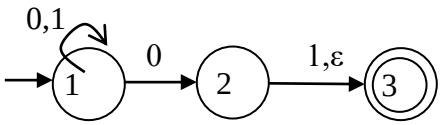
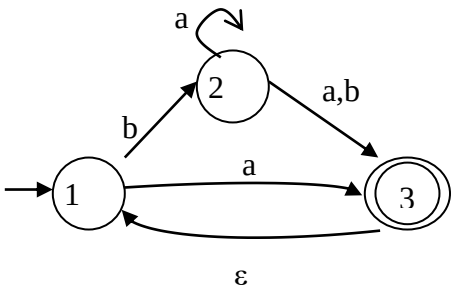
1. Consider the machine NFA(N).

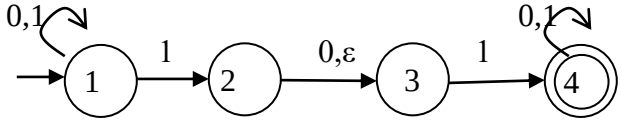
i)



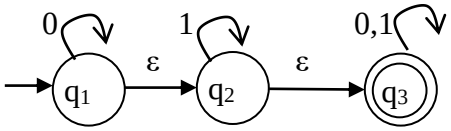
ii)



iii)



iv)



Construct a DFA that is equivalent to N.

2.

Chomsky Normal Form

1) Convert the following CFG to Chomsky Normal Form and write all the steps:
   $S \to ASB \mid \varepsilon$
   $A \to aAS \mid a$
   $B \to SbS \mid A \mid bb$

2) Convert the following CFG to Chomsky Normal Form and write all the steps:
   $S \to 0A0 \mid 1B1 \mid BB$
   $A \to C$
   $B \to S \mid A$
   $C \to S \mid \varepsilon$

3) Convert the following CFG to Chomsky Normal Form and write all the steps:
   $S \to AAA \mid B$
   $A \to aA \mid B$
   $B \to \varepsilon$

4) Convert the following CFG to Chomsky Normal Form and write all the steps:
   S → aXbX
   X → aY | bY | ε
   Y → X | c

Pushdown automata (PDA)

1) Discuss and design the Pushdown automata (PDA) that recognizes the language $\{0^n 1^n \mid n \geq 0\}$. Show all the stack conditions for each transition for the following strings and verify if they are accepted or not:
   i) $\{0^3 1^3\}$
   ii) {01011}
   iii) {001010}

2)Discuss and design the Pushdown automata (PDA) that recognizes the language $\{1^n 0^n \mid n \geq 0\}$. Show all the stack conditions for each transition for the following strings and verify if they are accepted or not:
   i) $\{111000\}$
   ii) {110010}

3) Design the Pushdown automata (PDA) that recognizes the language $\{ww^R \mid w \in \{0,1\}^*\}$. Show all the stack conditions for each transition for the following strings and verify if they are accepted or not:
   i) $\{110011\}$ ii) $\{111000\}$

PDA from CFG

1) Construct a PDA from the CFG and show the stack status for the input ***aaab***

$$S \rightarrow aTb \mid b$$
$$T \rightarrow Ta \mid \varepsilon$$

1) Construct a PDA from the CFG show the stack status for the input **000#111**

$$A \rightarrow 0A1$$
$$A \rightarrow B$$
$$B \rightarrow \#$$

2) Construct a PDA from the CFG and show the snapshot with stack for the input ***aabbbb***.

R → S | T
S → aSb | ab
T → aTbb | abb