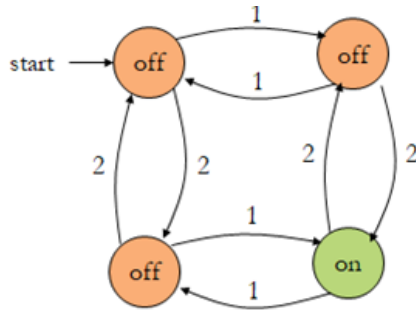


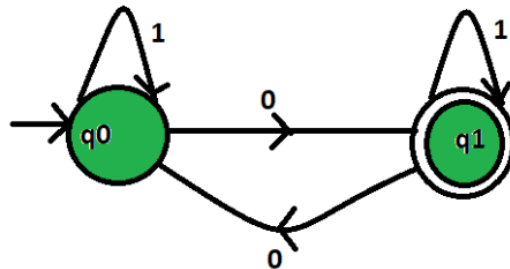
PART A: Answer the following

5 x 2 = 20 Marks

1. Draw the abstract model for the electrical circuit with one fan which can be controlled by two switches and battery.



2. How categorize the grammar for formal languages based on the restriction of variables and terminals the on the left or right side of the production
 - a. Type 3 - **Regular grammars**
 - b. Type 2 - **Context-free grammars**
 - c. Type 1 - **Context-sensitive grammars**
 - d. Type 0 - **Recursively enumerable grammar**



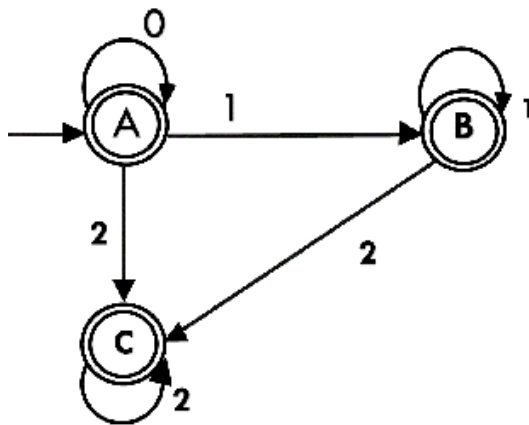
- 3.
4. a pushdown automaton MM is a 7-tuple $M=(Q, \Sigma, \Gamma, T, q_0, \perp, F)$ $M=(Q, \Sigma, \Gamma, T, q_0, \perp, F)$, where $Q, \Sigma, q_0, Q, \Sigma, q_0$, and FF , like those in an NDFA, are the set of states, the input alphabet, the start state, and the set of final states respectively. Γ is the *stack alphabet*, specifying the set of symbols that can be pushed onto the stack. Γ is not necessarily disjoint from Σ . \perp is an element of Γ called the *start stack symbol*.
5. Find the grammar that generates $L = \{a^n b^{n+1} : n \geq 0\}$
 - S \rightarrow Ab
 - A \rightarrow aAb
 - A \rightarrow
6. Identify the language accepted by the following DFA
ANSWER $L = \{w \mid w \in \{0, 1\}^* \text{ and starts with 1 and ends with 0}\}$.

7. Let L be an RL. Then, there exists an integer constant n (depending on L) such that for every string w in L with $|w| \geq n$, we can break w into three substrings, $w = xyz$, such that:
 $|y| > 1$ (i.e., y has at least one symbol);
 $|xy| \leq n$; and
for all $k \geq 0$, the “pumped” string xy^kz is also in L .
8. RL is closed union, concatenation, star closure, and intersection
9. Initial iteration equivalence states are $F=\{q3,q4\}$ and $NF=\{q1,q2,q3\}$
10. States $q1,q2,q3$ will be merged as single state and $q4, q5$ will be merged as another single state.

PART B: Answer the following

10 x 1 = 10 Marks

11. Convert the following e-NFA into its equivalent DFA



12. Basic DFA for the inputs \emptyset , ϵ , and char a -3 marks
Step-by-step procedure and answer – 7 marks
13. Justification – 3 marks
Selection of n and w as per the rule, selection of xyz – 3 marks
Proof by producing pumped strings – 4 marks