1) Consider the following statements

S1: Configuration graph of a string \( w_1 \) with respect to a deterministic TM \( M_1 \) is always a line graph.

S2: Configuration graph of a string \( w_2 \) with respect to a nondeterministic TM \( M_2 \) is never a line graph.

Which of the following is correct?

- S1 is true but S2 is false.
- S1 is false but S2 is true.
- Both S1 and S2 are false.

2) A transition \( \delta(p, X) = (q, Y, \Delta) \) is represented as

\[
\begin{array}{c}
p \\
X, Y, L \\
\rightarrow \\
q
\end{array}
\]

Now consider the following TM

Which of the following is the correct language of above TM?
3) Consider the following statements

S1: A TM in which we can stay at the current cell in addition to moving left and right at each step, accepts the same class of languages as a general TM.

S2: A TM having a bidirectional tape (can extend to infinity on both sides), accepts the same class of languages as a general TM.

Which of the following is correct?

- S1 is true but S2 is false.
- S1 is false but S2 is true.
- Both S1 and S2 are false.
- Both S1 and S2 are true.

4) Which of the following statements are true?

- Context free languages are a proper subset of the set of languages accepted by NFA with two queues.
- Decidable languages are a proper subset of the set of languages accepted by NFA with a priority queue.
- The set of languages accepted by DFA with 2 stacks is equivalent to deterministic context free languages.
- Context free languages are a proper subset of the set of languages accepted by DFA with two queues.
5) Consider the following TM

Which of the following is the correct language of this TM?

- \( \{ww \mid w \in \{0,1\}^*\} \)
- \( \{w0^n \mid w \in \{0,1\}^* \text{ and } |w| = n\} \)
- Set of binary strings with number of 0s at least half the length of the string
- Set of binary strings with more number of 0s than 1s.

6) Let \( L \) and \( M \) be two languages over \( \Sigma \). Define the following operations

- \( \text{Mix}(L, M) = \{w \mid w = a_1b_1\ldots a_kb_k \text{ where } a_1, a_2, \ldots a_k \in L \text{ and } b_1, b_2, \ldots b_k \in M \text{ and } a_i, b_i \in \Sigma\} \)
- \( \text{PerfectMix}(L, M) = \{w \mid w = a_1b_1\ldots a_kb_k \text{ where } a_1, a_2, \ldots a_k \in L \text{ and } b_1, b_2, \ldots b_k \in M \text{ and } a_i, b_i \in \Sigma^*\} \)

Which of the following is true?

- Decidable languages are closed under \( \text{Mix} \) but not under \( \text{PerfectMix} \)
- Decidable languages are not closed under \( \text{Mix} \) but closed under \( \text{PerfectMix} \)
- Decidable languages are closed under both \( \text{Mix} \) and \( \text{PerfectMix} \)
- Decidable languages are not closed under both \( \text{Mix} \) and \( \text{PerfectMix} \).
7) Consider the following Turing machine $M$.

Which of the following statements are true about $M$?

- $M$ is a halting TM.
- $M$ halts on some binary strings.
- $M$ does not halt on $w$ if $w \in L((0+1)^*1(0+1)^*1(0+1)^*1(0+1)^*)^*$.
- $M$ accepts every string that ends with a 1.

8) Let $L_1$ be a decidable and $L_2$ be a Turing recognizable language. Which of the following is necessarily correct?

- Both $L_1 - L_2$ and $L_2 - L_1$ are Turing recognizable.
- $L_1 - L_2$ is Turing recognizable.
- $L_2 - L_1$ is Turing recognizable.
- Both $L_1 - L_2$ and $L_2 - L_1$ are not Turing recognizable.