1) Let \( N \) be an NFA and \( w \) be a string. We say that \( N \) accepts \( w \), if
- all computation paths of \( N \) on \( w \) reach an accept state,
- exactly one computation path of \( N \) on \( w \) reaches an accept state,
- no computation path of \( N \) on \( w \) reaches an accept state,
- at least one computation path of \( N \) on \( w \) reaches an accept state.

2) Let \( \cdot \) and \( \cup \) be the concatenation and union operation as discussed in the lectures. Let \( A \) and \( B \) be two finite languages with cardinality (number of strings in the language) \( p \) and \( q \) respectively. Then what is the maximum number of strings in languages \( A \cdot B \) and \( A \cup B \) respectively?
- \( p^q \) and \( p \cdot q \)
- \( p^p \) and \( p + q \)
- \( p^q \) and \( p + q \)
- \( p \cdot q \) and \( p \cdot q \)

3) Consider the DFA \( M \) given below:

![DFA Diagram]

If \( L_1 \) = \{Set of binary strings when interpreted as integer is divisible by 3\}
\( L_2 \) = \{Set of binary strings whose reversal when interpreted as integer is divisible by 3\}

Which one of the following is correct?
- \( L_1 = L(A) \) but \( L_2 \neq L(A) \)
- \( L_1 \neq L(A) \) but \( L_2 = L(A) \)
- \( L_1 = L(A) \) and \( L_2 = L(A) \)
- \( L_1 \neq L(A) \) and \( L_2 \neq L(A) \)

4) What is the minimum number of states in a DFA that recognizes the set of all binary strings which contains four consecutive 1s?
- 6
- 5
- 4
- 3
6) Consider the following DFA:

Which one of the following is the language of the above DFA?
- Set of all binary strings which do not contain 101.
- Set of all binary strings which do not contain exactly two 1s.
- Set of all binary strings which do not contain at least two 1s.
- Set of all binary strings which do not contain at least two 1s separated by at least one 0.

6) Let $Q$ be the number of states in an NFA $N$. From any state in $N$, on reading an input symbol, $N$ can go to
- At most $Q-1$ states.
- At least $Q-1$ states.
- At most $Q$ states.
- At least 2 states.

7) Let $L$ be a language and $D$ be a DFA such that $L = L(D)$. Which of the following statement is necessarily true?
- There exists only one DFA which accepts $L$.
- There exists only finitely many DFAs which accept $L$.
- There exists an NFA which accepts $L$.
- There exists infinitely many DFAs which accept $L$. 
8) Which of the following is true?
   - Every NFA is also a DFA.
   - Every DFA is also an NFA.
   - There are some DFA which are not an NFA.
   - None of the above.

9) What is the language of the following NFA?

   - Set of all strings which contains aa or bb as a substring.
   - Set of all string which contains aa or bb as a substring but not both.
   - Set of all string which contains aa as a substring.
   - Set of all string which contains bb as a substring.
10) Let \( A \) and \( B \) be two sets of binary strings. A string in \( A \) when interpreted as an integer is divisible by 2 and a string in \( B \) when interpreted as an integer is divisible by 3. Let \( . \) be the concatenation operation. Which of the following is false?

- A string in \( A.B \) when interpreted as an integer is divisible by 5.
- A string in \( B.A \) when interpreted as an integer is divisible by 5.
- At least one of \( A.B \) and \( B.A \) is the set of strings which when interpreted as integer is divisible by 6.
- There exists such \( A \) and \( B \) such that, strings in \( A.B \) and \( B.A \) when interpreted as an integer is divisible by 6.

11) What is the language of the following DFA?

- Set of all strings \( s \), such that \( s \) contains substrings consist of all \( "a" \), separated by a single \( "b" \).
- Set of all string which does not contain substring \( "aa" \).
- Set of all string which does not contain substring \( "aa" \) and ending with an \( "a" \).
- None of the above.

12) Let \( \Sigma = \{0, 1\} \) Which of the following words are in the language \( \Sigma^2 \)?

- 00
- 0011
- 0101
- 01