1) Which of the following statements are false?

- If $A \leq_m B$ and $B \leq_m C$ then $A \leq_m C$

- If $A \leq_m B$ then $B \leq_m A$

- If $A$ is co-Turing recognizable and $A \leq_m \overline{A}$ then $A$ is decidable

- If $A$ is Turing recognizable and $A \leq_m \overline{A}$ then $A$ is decidable

2) Which of the following languages are not Turing recognizable?

- $L_1 = \{ <D> \mid D$ is a DFA and $L(D) = \Sigma^* \}$

- $L_2 = \{ <M, w> \mid M$ is a Turing machine and $M$ accepts $w \}$

- $L_3 = \{ <G> \mid G$ is a CFG and $L(G)$ contains infinite strings\}

- $L_4 = \{ <M, w> \mid M$ is a Turing machine and $M$ does not accept $w \}$

3) Which of the following statements are necessarily true?

- If $A \leq_m B$ and $B$ is a regular language, then $A$ is also a regular language

- If $A \leq_m B$ and $A$ is a regular language, then $B$ is also a regular language

- If $A \leq_m B$ and $B$ is a decidable, then $A$ is also decidable

- If $A \leq_m B$ and $A$ is decidable, then $B$ is also decidable.
4) Which of the following languages are decidable?

- $L_1 = \{ <M> | M \text{ is a Turing machine that accepts } w^R \text{ whenever it accepts } w \}$
- $L_2 = \{ <M> | M \text{ is a regular expression which generates at least one string containing an odd number of } 1s \}$
- $L_3 = \{ <G> | G \text{ is a context-free grammar which generates at least one string of all } 1s \}$
- $L_4 = \{ <M> | M \text{ is a Turing machine that has a state which is never entered on any input} \}$

5) To which class does the following language belong?

$L = \{ <M> | M \text{ is a Turing machine and } M \text{ accepts at least three strings} \}$

- Context free language
- Decidable but not context free
- Turing recognizable but not decidable
- Co-Turing recognizable

5) Let $L_1 = \{ <M, w> | M \text{ is a Turing machine and } M \text{ halts on the input } w \}$

$L_2 = \{ <M, w> | M \text{ is a Turing machine and } M \text{ does not halt on the input } w \}$

Which of the following statements is true?

- $L_1$ and $L_2$ are both not Turing recognizable
- $L_1$ is Turing recognizable but $L_2$ is not Turing recognizable
- $L_1$ is not Turing recognizable but $L_2$ is Turing recognizable
- $L_1$ and $L_2$ are both Turing recognizable
7) To which class does the following language belong?

\[ L = \{ <M> \mid M \text{ is a Turing Machine and } L(M) \text{ is Turing recognizable} \} \]

- Neither Turing recognizable nor co-Turing recognizable
- Decidable
- Turing recognizable but not decidable
- co-Turing recognizable

8) Which of the following statement is false?

- There exist a language which is both undecidable and Turing recognizable
- There exist a language which is both decidable and Turing recognizable
- There exist a language which is both undecidable and not Turing recognizable
- There exist a language which is both decidable and not Turing recognizable

9) Consider these languages:

- \( L_1 = \{ <M, w, 0> \mid M \text{ is a Turing machine which does not accept } w \} \)
- \( L_2 = \{ <M, w, 1> \mid M \text{ is a Turing machine which accepts } w \} \)

Which of the following statement is true?

- \( L_1 \cup L_2 \) is decidable
- \( L_1 \cup L_2 \) is Turing recognizable
- \( L_1 \cup L_2 \) is co-Turing recognizable
- \( L_1 \cup L_2 \) is neither Turing recognizable nor co-Turing recognizable
10) Which of the following statements are true?

- If $A$ is decidable, then $A \leq_m \overline{A}$
- If $A$ is Turing recognizable then $A \leq_m \overline{A}$
- If $A$ is co-Turing recognizable then $A \leq_m \overline{A}$
- If $A$ is undecidable, then $A \leq_m \overline{A}$