Lecture 23: Unsolvable Problems, Part I

1) We know that R and RE are different classes of languages. Which of the following statements is true?
   A) We know that $R \neq RE$ because all TMs are deciders, but not all deciders are TMs.
   B) We know that $R \neq RE$ because TMs are allowed to loop on their inputs.
   C) We know that $R \neq RE$ because $A_{TM}$ is undecidable.
   D) All of the above.

   Explanation:

Lecture 24: Unsolvable Problems, Part II

2) Suppose $V$ is a verifier for a language $L$. You run $V$ on the input string $\langle x, y \rangle$ and $V$ accepts. Which of the following statements MUST be true?
   A) $\langle x, y \rangle \in L$
   B) $x \in L$
   C) $y \in L$
   D) $\langle x, y \rangle \notin L$
   E) $x \notin L$
   F) $y \notin L$
   G) None of these

   Explanation:
3) Suppose \( V \) is a verifier for a language \( L \). You run \( V \) on the input string \( \langle x, y \rangle \) and \( V \) rejects. Which of the following statements MUST be true?

A) \( \langle x, y \rangle \in L \)
B) \( x \in L \)
C) \( y \in L \)
D) \( \langle x, y \rangle \notin L \)
E) \( x \notin L \)
F) \( y \notin L \)
G) None of these

Explanation:

4) Let \( M \) be a TM that always loops. Which of the following is true?

A) \( \langle M, \langle M \rangle \rangle \notin A_{TM} \) and \( \langle M \rangle \notin L_D \)
B) \( \langle M, \langle M \rangle \rangle \notin A_{TM} \) and \( \langle M \rangle \in L_D \)
C) \( \langle M, \langle M \rangle \rangle \in A_{TM} \) and \( \langle M \rangle \notin L_D \)
D) \( \langle M, \langle M \rangle \rangle \in A_{TM} \) and \( \langle M \rangle \in L_D \)

Explanation: