Lecture 20: Turing Machines, Part I

1) Suppose you run the TM $M$ on the input string $w$. $M$ enters an accepting state with string $x$ written on its tape, surrounded by infinitely many blanks. What can you conclude?

A) $M$ accepts the string $w$.
B) $M$ accepts the string $x$.
C) $M$ accepts the string formed by surrounding $w$ with infinitely many blanks.
D) $M$ accepts the string formed by surrounding $x$ with infinitely many blanks.
E) None of these.

Explanation:

2) When a Turing machine is started up, is it possible for its tape to be completely blank?

A) No, since the input string is always written somewhere on the tape.
B) No, because the Turing machine has infinitely many tape cells.
C) Yes, if the input string is empty.
D) Yes, if the input string has copies of the blank symbol in it.

Explanation:

Lecture 21: Turing Machines, Part II

3) Let $M$ be a Turing machine. Suppose that you run $M$ on some string $w$, and the machine $M$ accepts $w$. Which of the following statements is guaranteed to be true about the relation between $M$ and $w$?

A) $\mathcal{L}(M) = \{w\}$
B) $w \in \mathcal{L}(M)$
C) Both of the above options.
D) None of the above options.

Explanation:
4) Let $M$ be a Turing machine. Suppose that you run $M$ on some string $w$, and the machine $M$ loops on $w$. Which of the following statements is true?

A) Without more information, we cannot say whether $w \in \mathcal{L}(M)$ or $w \notin \mathcal{L}(M)$.

B) $M$ is a recognizer for the complement of the language $\{w\}$.

C) $M$ rejects $w$.

D) $M$ is not a decider.

Explanation:

Lecture 22: Turing Machines, Part III

5) Which of the following most accurately describes the universal Turing machine?

A) The universal Turing machine is a Turing machine that accepts all strings.

B) The universal Turing machine is a single Turing machine made out of all possible Turing machines.

C) The universal Turing machine takes as input a string, then returns whether any possible Turing machine would accept that string.

D) The universal Turing machine takes as input a TM and a string, then simulates the TM on that string.

Explanation:

6) Which of the following statements is true about $A_{TM}$?

A) If $\langle M, w \rangle \notin A_{TM}$, then $U_{TM}$ rejects $\langle M, w \rangle$.

B) If $\langle M, w \rangle \in A_{TM}$, then $U_{TM}$ accepts $\langle M, w \rangle$.

C) If $U_{TM}$ loops on $\langle M, w \rangle$, then $\langle M, w \rangle \in A_{TM}$.

D) If $M$ accepts $w$, then $w \in A_{TM}$.

Explanation: