1. True/False: A multi-tape TM has the same power as a standard TM.  
\[ \text{True} \]

2. True/False: If a language is the output of some Printer-TM, then it must be r.e.  
\[ \text{True} \]

3. The hierarchy of languages that we studied was proposed by  
   (a) Oprah Winfrey  
   (b) Noam Chomsky  
   (c) Good Will Hunting  
   (d) Anthony Fauci  
\[ \text{B} \]

4. Which of the following is true about recursive languages?  
   (a) All finite languages are recursive  
   (b) No finite language is recursive  
   (c) All infinite languages are recursive  
   (d) No infinite language is recursive  
\[ \text{A} \]

5. Which of the following is NOT true about the set of languages that have an unrestricted grammar?  
   (a) It is closed under star  
   (b) It is closed under concatenation  
   (c) It is closed under union  
   (d) It is closed under complementation  
\[ \text{D} \]
6. Which of the following problems is NOT decidable?
   (a) Does an RE generate the string "purple"?
   (b) Does an RE generate everything?
   (c) Does a CFG generate the string "purple"?
   (d) Does a CFG generate everything?  

d)

7. True/False: The following problem is decidable: determining whether a TM ever halts within 100 steps.
   True

8. Which of the following decision problems is decidable?
   (a) The halting problem for TMs
   (b) The halting problem for nondeterministic TMs
   (c) The halting problem for NFAs
   (d) The halting problem for 2-PDAs

   c)

9. True/False: The proof that $S_{tm}$ is not r.e. uses “proof by contradiction”
   True

10. Which of the following is NOT true about the language $A_{tm}$?
    (a) It is recursive
    (b) It is r.e.
    (c) It is infinite
    (d) It consists of the encodings $⟨M, w⟩$ such that $M$ accepts $w$

    a)

11. The proof that $S_{tm}$ is not r.e. relies on the fact that a TM can recognize its own representation.
    False

12. True/False: If $P$ is the language of binary palindromes, then $P$ reduces to its complement.
    True
13. Which of the following is NOT true about diagonalization?

(a) It produces a string not on a list
(b) It is used in the proof that $A_{tm}$ is r.e.
(c) It is used in the proof that $A_{tm}$ is not recursive.
(d) It is used in the proof that $S_{tm}$ is not r.e.

14. Which of the following sets is NOT countable?

(a) Unary strings
(b) CFGs
(c) Languages
(d) DFAs

15. Assume that language $A$ reduces to language $B$, and language $B$ reduces to language $C$. Which of the following is guaranteed to be true?

(a) $C$ reduces to $A$
(b) $A$ reduces to $C$
(c) $B$ reduces to $A$
(d) This situation is impossible