CSE 207 Class Test 2 (Dec 23, 2020) Total pts: 20 Time: 20 minutes

Name: _____ Std No: _____

Q.1 (1.5 * 4 = 6) Circle exactly one best answer for each of the following four multiple-choice problems.

1. The class *NP* is the set of all decision problems that:
   a. Can be solved by polynomial-time algorithms.
   b. Can definitely *not* be solved by polynomial-time algorithms.
   c. Have polynomial-time algorithms that can verify potential solutions.
   d. All of the above.
   e. None of the above.

2. The class *NP*–complete is the set of all decision problems that:
   a. Can be solved by polynomial-time algorithms.
   b. Can definitely *not* be solved by polynomial-time algorithms.
   c. Have polynomial-time algorithms that can verify potential solutions.
   d. All of the above.
   e. None of the above.

3. Suppose $X \leq_p Y$. Which must be true?
   a. Problem X is polynomial-time reducible to problem Y.
   b. Problem Y is polynomial-time reducible to problem X.
   c. Problems X and Y are equivalent in terms of computational complexity.
   d. Both (a) and (c).
   e. None of the above.

4. Suppose problem X is in class *P*, problem Y is in class *NP*, and $Y \leq_p X$. Which must be true?
   a. Problem Y is in class *P*.
   b. Problem Y is *NP*–complete.
   c. P = NP
   d. Both (a) and (c)
   e. None of the above.

Q.2 (4*1*5 = 6) Indicate whether the following statements are True or False (T/F)

i) If PRIME is in NP-complete, then P ≠ NP.
ii) NP=co-NP => P = NP.
iii) NP-hard problems which are not NP-complete are not in NP.
iv) The TAUTOLOGY problem asks if a given Boolean formula is true for all possible assignments to the Boolean variables. TAUTOLOGY is in co-NP.

Q. 3 (4+4 = 8 pts)

i) Suppose you have found a problem which is in NP but not in P. Why do you think your finding is important?

ii) Point out and briefly discuss the fallacy in the following "proof" that P ≠ NP:
"To see if a 3-SAT formula is satisfiable, we need to look at 2^n possible truth assignments. This takes exponential time, so 3-SAT is not in P. But it is in NP, so P ≠ NP."