

CSE 207 (Data Structures and Algorithms II)
Class Test 2 (Feb 20, 2022) Time: 25 minutes

Name: _____

Std No: _____

Q. 1 (5*2 = 10 pts)

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. Both (b) and (c)
 - 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
5. Consider two *NP*-hard problems *A* and *B*. Which of the following statement must be true?
 - a. *A* and *B* are the hardest problems in *NP*
 - b. Both *A* and *B* are of same level of complexity
 - c. *A* is as hard as *B*
 - d. *B* is as hard as *A*
 - e. *A* and *B* are as hard as the problems in *NP*

Q. 2 (3+3+4 = 10 pts)

(a) The TAUTOLOGY problem asks if a given Boolean formula is true for all possible assignments to the Boolean variables. TAUTOLOGY is in co-NP. Do you agree with this statement? Justify your answer.

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

(c) Point out and briefly discuss the fallacy in the following “proof” that $P \neq NP$:

“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 $P \neq NP$.”