1. Select all of the following statements about the bin packing problem that are true?

a) The bin packing problem can be solved using a recursive algorithm. -**True**

b) The set-partition problem can reduce to the decision version of the bin packing problem. - **True**

c) There exists a 1-approximation polynomial time algorithm for the bin packing problem.

d) The decision version of the bin packing problem is in P. - **True**

e) First-Fit is a 2-approximation algorithm for the bin packing problem. - **True**

2. If P does not equal NP, then there must exist a polynomial-time algorithm for 3-SAT.  True  False

**False**

Polynomial time algorithm can be used when p is equal to np.

To verify and to compute the problems we can use polynomial time .

But when p is not equal to np it is difficult to verify or to solve the problems with np and can not be verified using polynomial time algorithm

3. Every problem in P can be reduced to 3-SAT.  True  False

**False ------------🡪True?**

Every problem in P can be reduced to **CIRCUIT-SAT. So the speified statement is wrong.**

4. Every problem in P is also in NP.

**True**

5. You are using a polynomial time 2-approximation algorithm to find a tour t for the traveling

salesman problem. Which of the following statements is true.

* The tour t is never optimal. - **False**
* The cost of tour t is at most twice the cost of the optimal tour. - **True**
* The cost of tour t is always 2 times the cost of the optimal tour - **False**
* The ratio of the cost of the optimal tour divided by the cost of tour t is 2. – **False(opp is true)**
* All of the above. - **False**

6. If you discover a polynomial time algorithm for the 0-1 knapsack problem this will imply that P=NP.

**True**

7.

a) Verbally describe an efficient greedy approximation algorithm that finds a minimum vertex cover specifically for graphs that are trees. b) What is the running time of the algorithm? c) Use the graphs below to compare your algorithm to the 2-OPT approximation algorithm for vertex cover in that selects edges.

Greedy – exact

Non greedy -

8. Show that the Hamiltonian Cycle problem for directed graphs is in NP-Complete.

Go through every vertex

Abcda, remove a

9. 4-SAT: Given a CNF formula  with four literals per clause, is there a satisfying assignment? Prove that 4-SAT is NP-complete.

10. Use induction to prove the correctness of Merge-Sort

MERGE-SORT(A,p,r)

if p < r

q= (p+r)/2

MERGE-SORT(A,p,q)

MERGE-SORT(A,q+1,r) MERGE(A,p,q,r)