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Problems on NP-completeness

[Q-1] RAM and SAM have been asked to show that a certain problem π is NP compute. RAM shows a optimal time reduction from the 3-SAT problem to π, and shyam shows a polynomial time reduction from π to 3-SAT. What is π.

→ $\underset{(NPC)}{3SAT} \xrightarrow{\text{"p"}} \pi^{(NPH)}$

π is NP-hard.

[Q-2] The problem 3-SAT and 2-SAT are.

→ $(a+b+c) \downarrow$ NPC $\quad (a+b) \downarrow$ P

[Q-3]

Let 's' be a NP complete problem and 'Q' and 'R' be two other problems not known to be in NP. 'Q' is polynomial time reduciable to 's' and 'S' is polynomial-time reducible to 'R'.

→ $(Q) \xrightarrow{'p'} S \xrightarrow{'p'} R$

R is NP-Hard.

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[Q-4]

Let 'A' be a problem that belongs to the class NP then which one of the following is true?

X a) There is no polynomial time algorithm for 'A'.
X b) If 'A' can be solved deterministically in polynomial time, then, P = NP.

✓ c) If 'A' is NP-hard then it is NP-complete.
X d) 'A' may be undecidable.

[Q-5]

Which of the following is true —

✓ 1) The problem of determining whether there exists a cycle in an undirected graph is in 'P'.

✓ 2) The problem ~~is~~ of determining whether there exists a cycle in an undirected graph is 'NP'.

✓ 3) If a problem 'A' is NP-complete, there exists a nondeterministic polynomial time algo to solve 'A'.

[Q-6] Which of the following is not NP-hard?

a) Hamiltonian circuit problem. (NP-H)
b) 0/1 Knapsack problem. (NP-H)
✓ c) Finding bi-connected components of ~~a~~ a graph. (P)
d) The graph colouring problem. (NP-H)

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Q-7

Let $SHAM_3$ be a problem of finding Hamiltonian Cycle in a graph $G=(V,E)$ with $|V|$ divisible by '3' and $DHAM_3$ be a problem of determining if Hamiltonian cycle exists in such graphs. Which of the following is true.

→

$SHAM_3$ —— $DHAM_3$

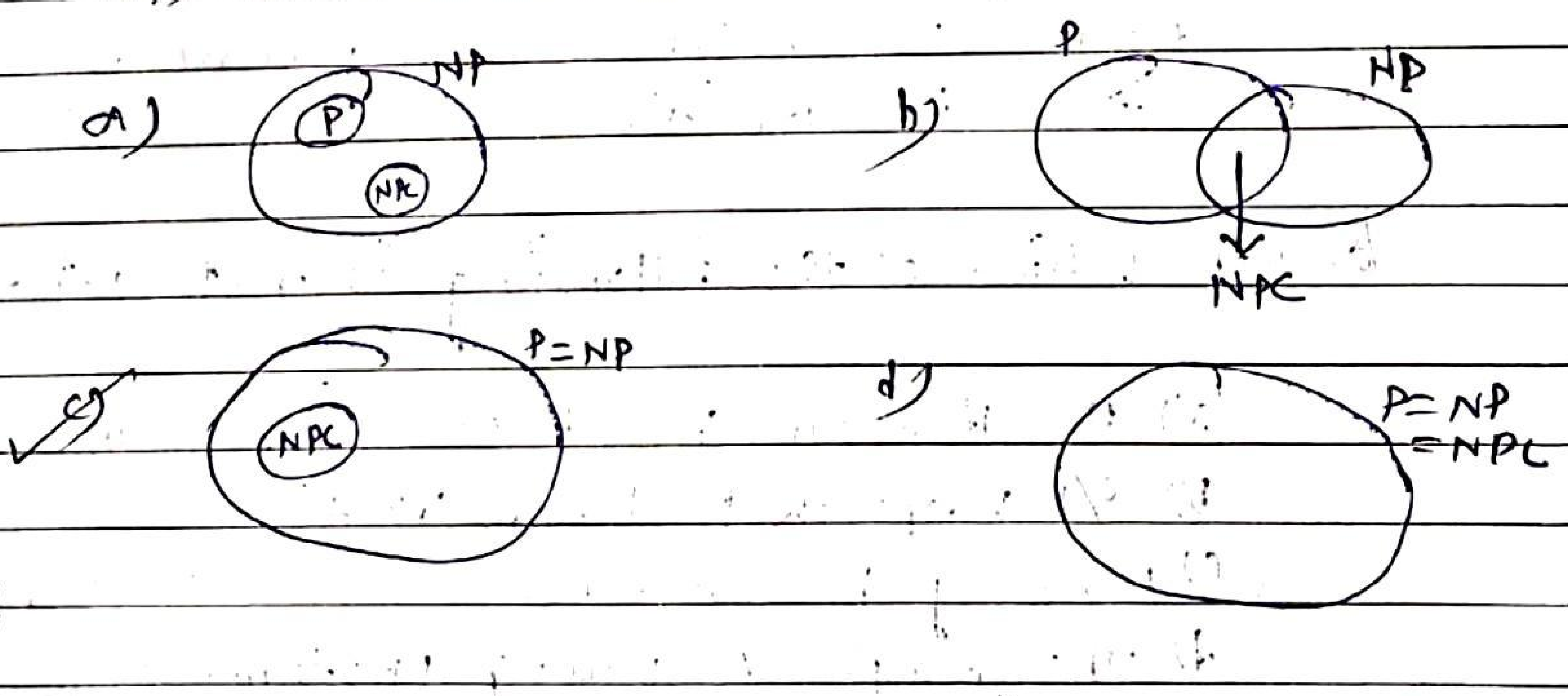
(Optimisation problem) — NP + NP-hard = NPC

(Decision problem) — NP + NP-Hard = NPC

- both ~~the problem~~ are NP-complete. (NP-C)

Q-8

Suppose a polynomial time algorithm is discovered that correctly compute the largest (NP-H) Clique in a given graph. In this scenario, whic one of the following represents the correct venn diagram of the complexity classes P, NP, and NPC.



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Q-9

consider the decision problem → 2CNF - SAT

X (a) NP complete.
✓(b) solvable in polynomial time by reduction to directed graph readability.

X (c) solvable in constant time since any input instance is satisfiable.
(d) NP-Hard, but not NPC.

Q-10

If an NP-hard problem can be solved polynomial time, then P=NP (T/F)

Q-11

The set of NP problems is not ~~co~~ closed under polynomial time reductions (T/F).