

1. [8 marks] Let t be the transformation we saw in the lectures from cnf-sat to 3-sat. For the cnf-sat formula f represented below, give the corresponding 3-sat formula $t(f)$. In this question, write boolean clauses like this $[-1 \ 2 \ 4]$ instead of like this $(\neg x_1 \vee x_2 \vee x_4)$.

clauses of f

corresponding clauses of $t(f)$

$[-1 \ 3 \ 5 \ 6]$

$[2 \ 3 \ -4 \ -5 \ -6]$

$[1 \ -2 \ 3 \ -4 \ 5 \ 6]$

----- ROUGH WORK BELOW THIS LINE -----

2. [7 marks] Does there exist a polytime answer-preserving transformation from k -clique to cnf-satisfiability (cnf-sat)? Write your answer here (yes/no/not known):

Justify your answer here:

3. [3 + 4 + 4 + 4 marks] Recall from the lectures the polytime answer-preserving transformation $t(\cdot)$ that maps any 3-sat instance z with k clauses to a k -independent set instance $t(z)$ where $t(z)$ is a graph.

a) On the nodes below, draw $t(z)$. Label each node with its corresponding literal.

$$z = (\neg x_1 \vee x_2 \vee x_3) \wedge (x_1 \vee \neg x_2 \vee x_3) \wedge (\neg x_1 \vee x_2 \vee x_3) \wedge (\neg x_1 \vee \neg x_2 \vee \neg x_3)$$



b) Assume that $t(z)$ has an independent set I of size k . For each statement below, write T (true) or F (false) and justify your answer.

i) I includes exactly one node from the first clause of z .

T/F? _____ Reason?

ii) I can contain a node labelled $\neg x_j$ and a node labelled x_j .

T/F? _____ Reason?

iii) Let A be the truth assignment that sets each literal that is a node of I to true. A satisfies z .

T/F? _____ Reason?

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b) Assume that $t(z)$ has an independent set I of size k . For each statement below, write T (true) or F (false) and justify your answer.

i) If I contains a node labelled $\neg x_j$, then I does not contain a node labelled x_j .

T/F? _____ Reason?

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ROUGH WORK BELOW THIS LINE

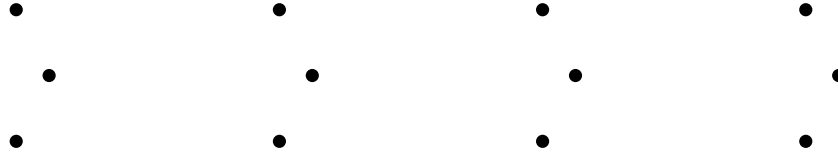
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