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 $t(\ )$ 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.

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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.

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