1. `node_subset_is_clique` (NSIC) is this problem:

   instance: a graph $G = (V, E)$ and a subset K of V.

   query: is K a clique of G?

   Give a polytime algorithm for NSIC.

2. Recall that k-clique is this problem:

   instance: a graph $G = (V, E)$ and an integer k.

   query: does G have a clique of size k?

   Prove/disprove: k-clique is in the class NP. In your answer, use NSIC.

1. 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. Does there exist a polytime answer-preserving transformation from k-independent set to sat (satisfiability)? Write your answer here (yes/no/not known):

   Justify your answer here:

5. 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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