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הוכחה נוספת

$$NP \subseteq \exists SAT = \left\{ \phi \mid \exists \alpha \cdot \alpha(\phi) = 1 \right\}$$

$$\exists SAT = \left\{ \phi \mid \phi \in CNF, \exists \alpha \cdot \alpha(\phi) = 1 \right\}$$

$$DNF \quad n-1 \text{ de } v$$

$$CNF \quad n-V \text{ de } 1$$

$$\exists SAT = \left\{ \phi \mid \phi \in DNF, \exists \alpha \cdot \alpha(\phi) = 1 \right\}$$

$$\exists SAT \in P$$

הוכחה נוספת, clause סדרה נכונה בעד
הוכחה נוספת

$$DNF \quad n-1 \text{ de } v \quad CNF \quad n-V \text{ de } 1$$

הוכחה נוספת, $P \neq NP$ נכונה

$$\left(\begin{array}{l} \exists CNF \quad n-1 \text{ de } v, \text{ הוכחה נוספת } \\ DNF \quad n-1 \text{ de } v, \text{ הוכחה נוספת } \\ (NP \subseteq \exists CNF) \quad P \neq NP \end{array} \right)$$

$$T \exists SAT = \left\{ \phi \mid \phi \in DNF, \forall \alpha \cdot \alpha(\phi) = 1 \right\}$$

$$T \exists SAT \in co-NP$$

$$\overline{T \exists SAT} \in NP \quad \overline{T \exists SAT} = \left\{ \phi \mid \phi \notin DNF, \exists \alpha \cdot \alpha(\phi) = 0 \right\}$$

$$C-CNF = \{ \langle \phi, k \rangle \mid \phi \in CNF, \exists \delta \text{ s.t. } N(\phi, \delta) = k \}$$

- no negative clauses $\rightarrow$ only

$$C-CNF \leq_p 3-SAT$$

$$NP \subseteq 3-SAT \leq_p C-CNF$$

$$C-CNF \in NP$$

no negative clauses $\rightarrow$ only

$$3-SAT \leq_p C-CNF$$

$$f(\phi) = \langle \phi, |\phi| \rangle$$

no negative clauses $\rightarrow$ only

$$C-DNF = \{ \langle \phi, k \rangle \mid \phi \in DNF, \exists \delta \text{ s.t. } N(\phi, \delta) = k \}$$

$$\phi \in CNF \Leftrightarrow \bar{\phi} \in DNF$$

$$\forall \delta \quad \delta(\phi) \neq \delta(\bar{\phi})$$

$$CNF \ni \phi \quad \langle \phi, k \rangle$$

$$DNF \ni \bar{\phi} \quad \langle \bar{\phi}, |\phi| - k \rangle$$

$$\langle \bar{\phi}, |\phi| - k \rangle \text{ is } C-DNF$$

$$\langle \phi, k \rangle \text{ is } C-CNF$$

$$NP \subseteq C-DNF \leq_p C-CNF$$

$$NP \subseteq C-DNF$$

VC - Vertex Cover
 $G = (V, E)$ for given

$\forall (u, v) \in E$ if $u \in V$ then
 $u \in U$
 or
 $v \in U$

Independent set
 $IS (V, E)$ $U \subseteq V$
 $\forall u, v \in U \quad (u, v) \notin E$

$VC = \{ \langle G, k \rangle \mid G \text{ has a VC of size } k \}$

$NP_C \ni IS = \{ \dots \}$ $IS \text{ of size } k$

$VC \in NP_C$

$IS \leq_P VC$

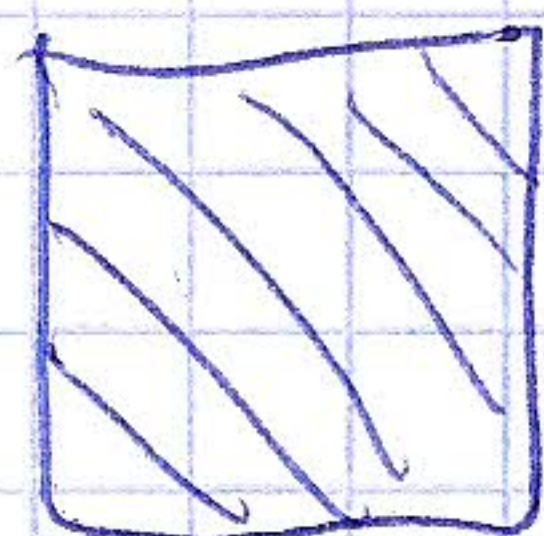
$\hookrightarrow$ reduction
 $VC \in NP_C$
 $\downarrow$
 NP_C - yes
 $\sim$ no

$$f(V, E, k) = (V, E, |V| - k)$$

$G \text{ has } IS \text{ of size } k \iff G \text{ has a VC of size } |V| - k$ for

$\sim$ if $|V| - k$ exists VC then $\leftarrow$
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 VC exists $\sim$ if $|V| - k$ exists VC then $\leftarrow$

$\sim$ if $|V| - k$ exists VC then $\rightarrow$
 $\sim$ if $|V| - k$ exists VC then $\rightarrow$
 $\sim$ if $|V| - k$ exists VC then $\rightarrow$



$|V| - k$ exists VC then $\rightarrow$

$$\text{Partition} = \left\{ S = \{x_1, \dots, x_n\} \mid \exists B \subseteq S, \sum_{x \in B} x = \sum_{x \in S \setminus B} x \right\}$$

$$\text{BIN Packing} = \left\{ S = \{x_1, \dots, x_n\}, B, m \mid \exists S_1, \dots, S_m, \bigcup_{i=1}^m S_i = S, \sum_{x \in S_i} x \leq B \right\}$$

BP $\in$ NPC

BP $\in$ NP

NP-hard

Partition $\leq_p$ BP

$$f(S) = \left(\sum_{x \in S} x, B, m \right)$$