3SAT

A 3nd conjunctive normal formula (3nd-formula) is a conjunction form with at most 3 literals at each clause

$$(x_1 \vee \overline{x_2} \vee \overline{x_3}) \wedge (x_3 \vee \overline{x_5} \vee x_6) \wedge (x_3 \vee \overline{x_6})$$

3SAT={ ϕ | ϕ is satisfiable 3nd-formula}

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3SAT is NP-complete

$$(a_1 \vee a_2 \vee a_3 \vee a_4)$$

is satisfiable if and only if the following is satisfiable

$$(a_1 \vee a_2 \vee z) \wedge (\overline{z} \vee a_3 \vee a_4)$$

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3SAT is NP-complete

$$(a_1 \vee a_2 \vee ... \vee a_l)$$

is satisfiable if and only if the following is satisfiable

$$(a_1 \vee a_2 \vee z_1) \wedge (\overline{z_1} \vee a_3 \vee z_2) \wedge$$
$$(\overline{z_2} \vee a_4 \vee z_3) \wedge ... \wedge (\overline{z_{l-3}} \vee a_{l-1} \vee a_l)$$

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3SAT is NP-complete

Convert every clause into
$$(a_1 \vee a_2 \vee ... \vee a_l)$$
3cnf:

$$(a_1 \vee a_2 \vee z_1) \wedge (\overline{z_1} \vee a_3 \vee z_2) \wedge$$
$$(\overline{z_2} \vee a_4 \vee z_3) \wedge ... \wedge (\overline{z_{l-3}} \vee a_{l-1} \vee a_l)$$

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3SAT is NP-complete

Conjunctive normal form
$$f_1 \wedge f_2 \wedge ... \wedge f_k$$

Each clause f_i is convert into $g_i (i = 1,2,...,k)$

$$f_1 \wedge f_2 \wedge ... \wedge f_k$$
is satisfiable if and only if the following is satisfiable
$$g_1 \wedge g_2 \wedge ... \wedge g_k$$

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Problem

Convert the formula F into 3SAT formula F' such that F is satisfiable iff and F' is satisfiable.

$$F = (x_1 \vee \overline{x_2} \vee \overline{x_3} \vee x_4) \wedge (x_3 \vee \overline{x_4} \vee \overline{x_5} \vee x_6)$$

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