

Metaheuristic Optimization

Lab 02 (Zero Marks) - NP-completeness

Week 2

- 1) This problem concerns of the proof of the NP-completeness of k-SAT
 - a) Convert the formula $F = (x \vee p) \wedge (-x \vee y \vee z \vee -p) \wedge (-y \vee q \vee -z)$ into a 3SAT formula, using the construction/reduction

Solution:

First Clause (We need clauses and 1 extra variable) $\rightarrow (x \vee p \vee U_1) \wedge (x \vee p \vee -U_1)$

Second Clause (We need 2 clauses and 1 extra variable) $\rightarrow (-x \vee y \vee U_2) \wedge (-U_2 \vee z \vee -p)$

Third Clause (already 3SAT) $\rightarrow (-y \vee q \vee -z)$

$$F' = (x \vee p \vee U_1) \wedge (x \vee p \vee -U_1) \wedge (-x \vee y \vee U_2) \wedge (-U_2 \vee z \vee -p) \wedge (-y \vee q \vee -z) \wedge (-y \vee q \vee -z)$$

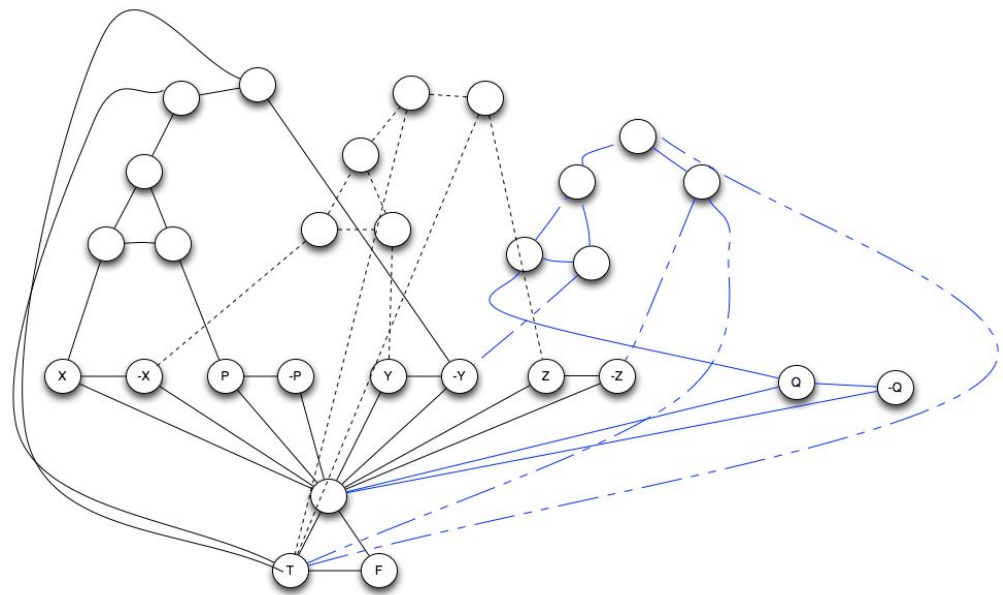
- b) Find a truth a solution for the 3SAT instance of F and verify that it is a solution for for the original problem.

I let you finish this part

- 2) This problem concerns of the proof of the NP-completeness of 3COL
 - a) Convert the formula $F = (x \vee p \vee -y) \wedge (-x \vee y \vee z) \wedge (-y \vee q \vee -z)$ into a 3COL graph

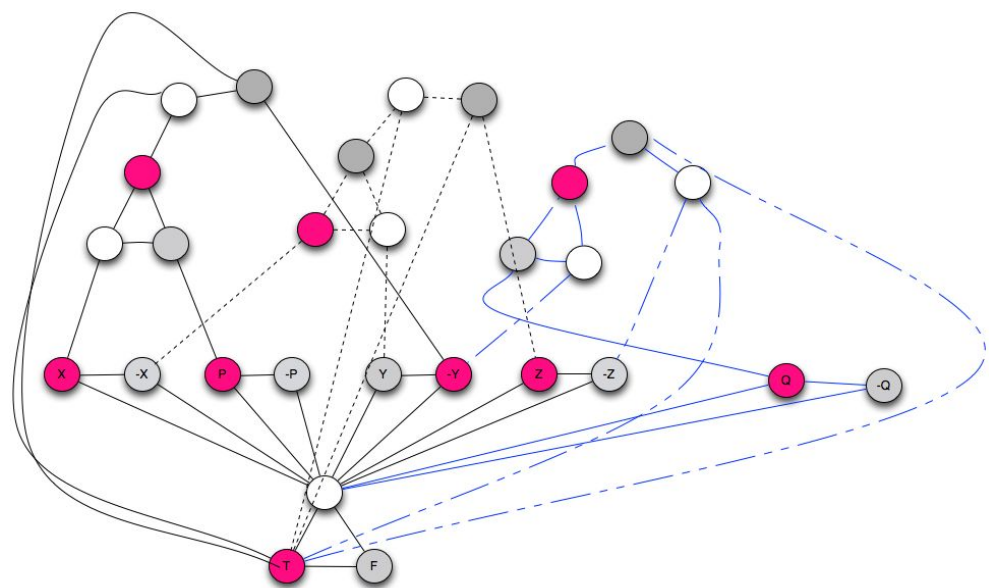
Solution:

Resulting Graph \rightarrow



b) Find a solution for the 3COL instance of F and verify that it is a solution for F

3COL solution →



I let you verify that this is a valid solution for F.