

ICCS310: Assignment 22

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1: Lecture 22

We already know that 3-SAT is in NP-Complete.

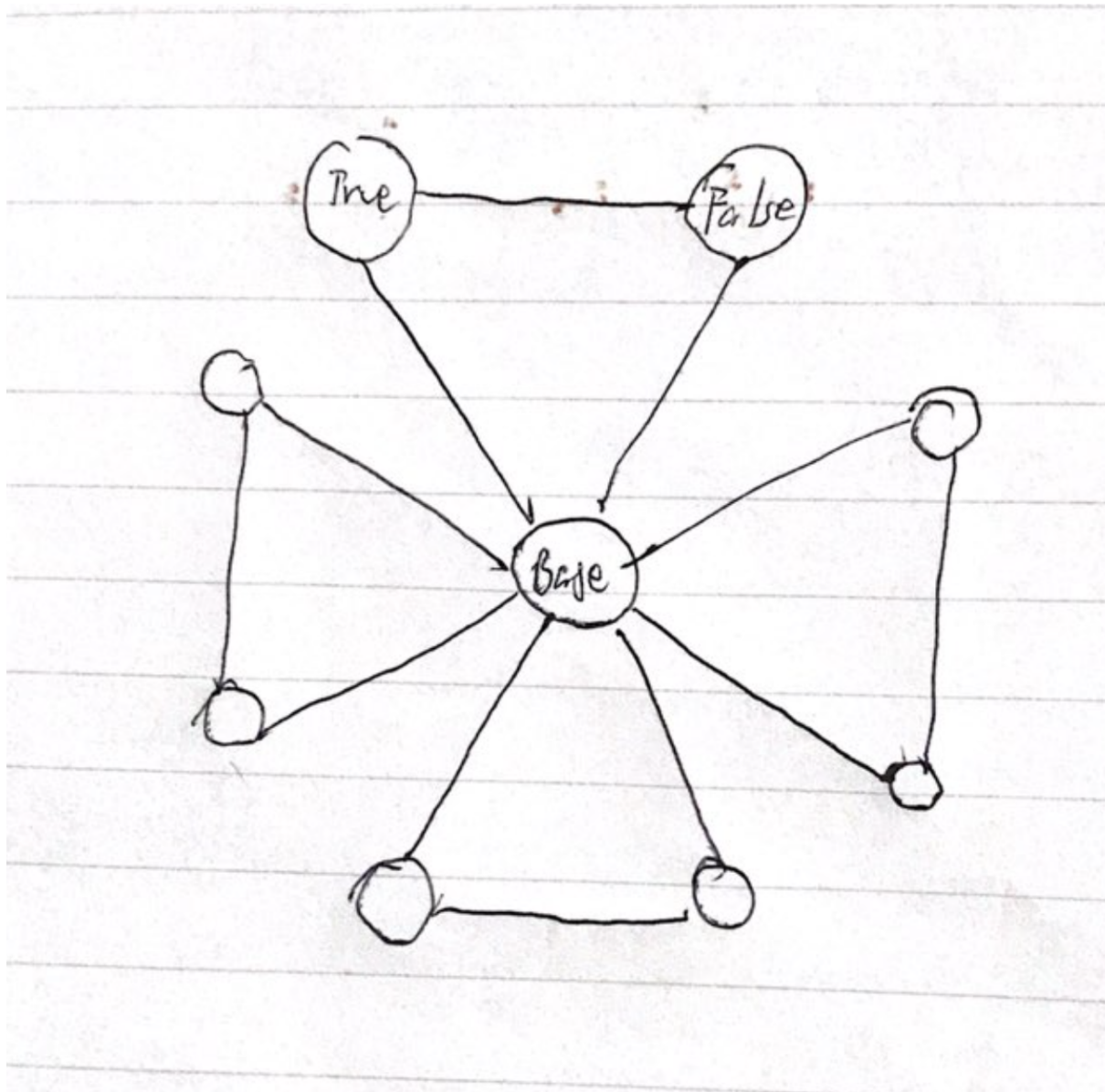
Assume that the 3-SAT problem has a 3-SAT formula of m clauses on n variables. Where n variables is denoted by x_1, \dots, x_n . Then we can construct a graph by:

1. For every x_i we create a vertex v_i which will work as a negation of x_i
2. For each clause c in m add 5 vertices
3. Three vertices of different colors are then added to denote the values True, False, and Base
4. Add edges between the True, False and Base to form a triangle
5. add edges among the vertices and the Base

Constraint of graph to make it True:

1. For each pair of vertices they shouldnot be assign to the same value
2. For each clause c in m at least one of the literal should hold True.

Example would be:



WLOG, assume that this is satisfiable. Then for every clause at least one of the literals x_i must be true, therefore the corresponding v_i will be assigned True and \bar{v}_i will be False. Hence the graph can be 3 coloured. Consider that the graph is 3-colorable, so if the vertex v_i is assigned to the True color, the corresponding variable x_i will be True. This will form a truth assignment. Hence 3-coloring is NP-Complete.