Week 9 Day 2 Lecture Notes

Prep:

- Quiz 5 Today. (Linear Programming and Reduction)
- Implementation 3 due in a week.
- Read DPV 8.1-8.3

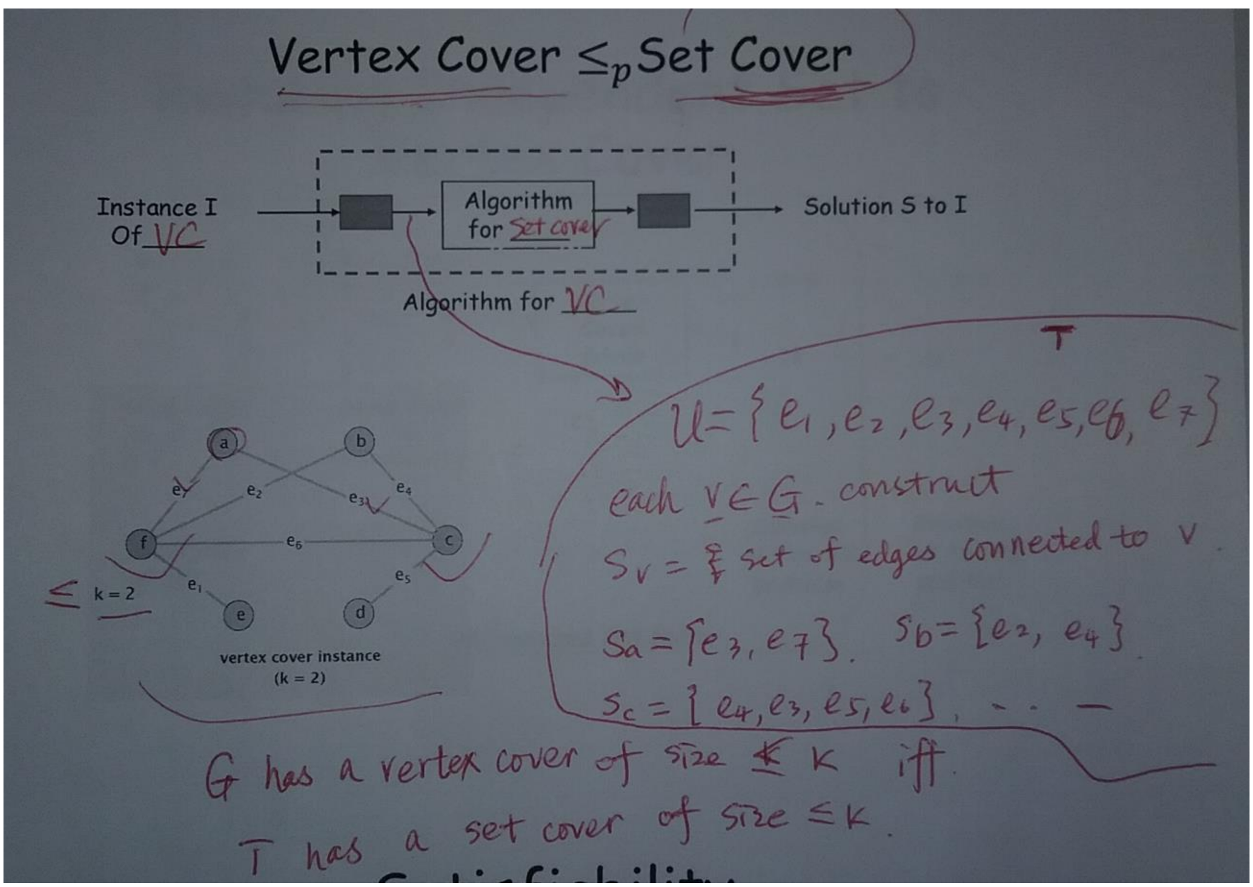
Set Cover:

Given a Degree and a set of classes that provide pre-requisites for the Degree what is the fewest # of classes you can take to complete the degree?

Vertex Cover: Every Edge has at least one end in the selected set. (Find **Minimum** # of nodes)

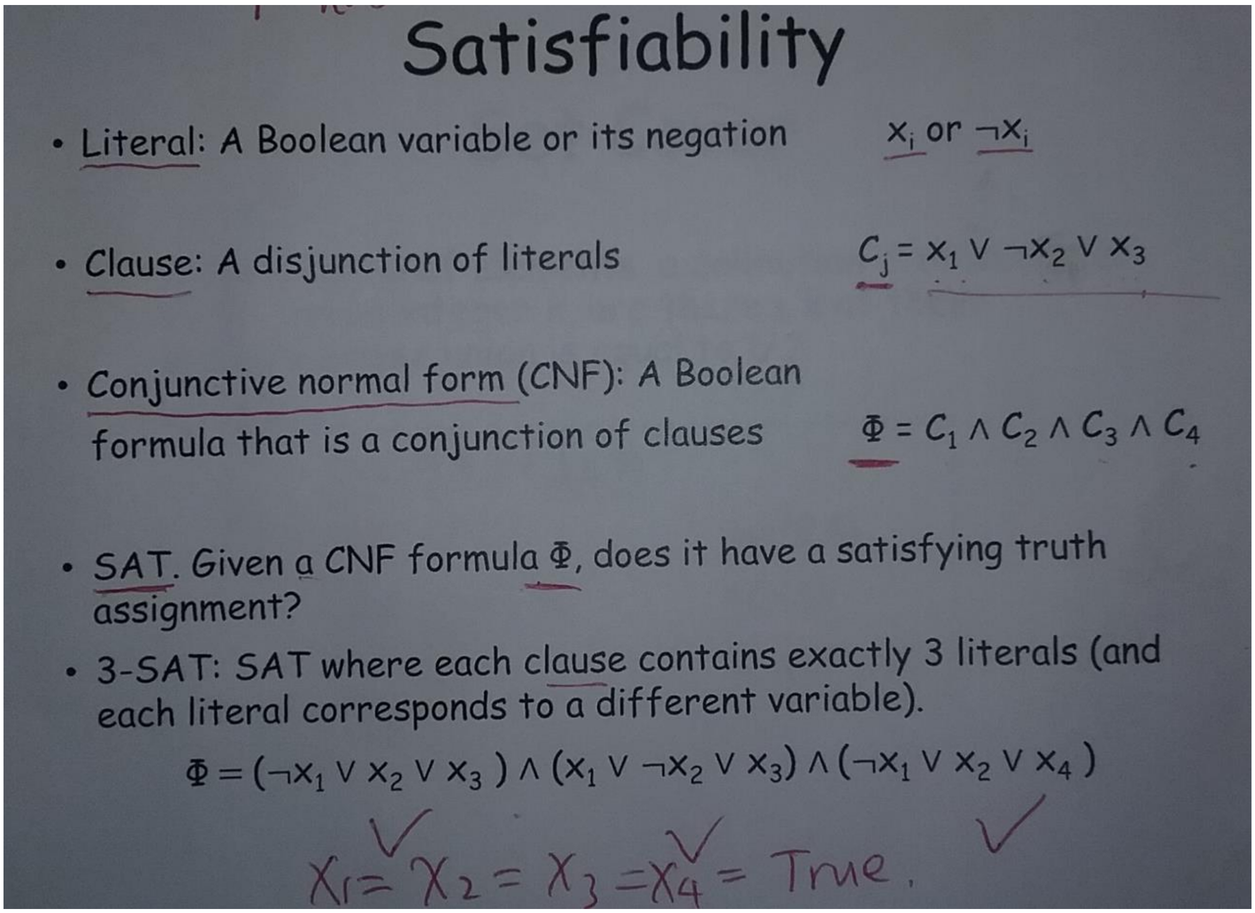
Independent Set: Each edge, at most has only one end point in the set. (find **Maximum** # of nodes)

Vertex Cover <= Set Cover



- Vertex Cover Reduces to Set Cover
- For each node n in the graph. Construct a set of edges e that are connected to that node n.
- Write out a set of connecting edges for every node.
- If there’s a Vertex Cover than there’s also a Set Cover.
- G has a Vertex cover of size <= K if T has a set cover of size <=k
- Can reduce Vertex Cover to Set Cover but not the other way.

Satisfiability: (SAT.)



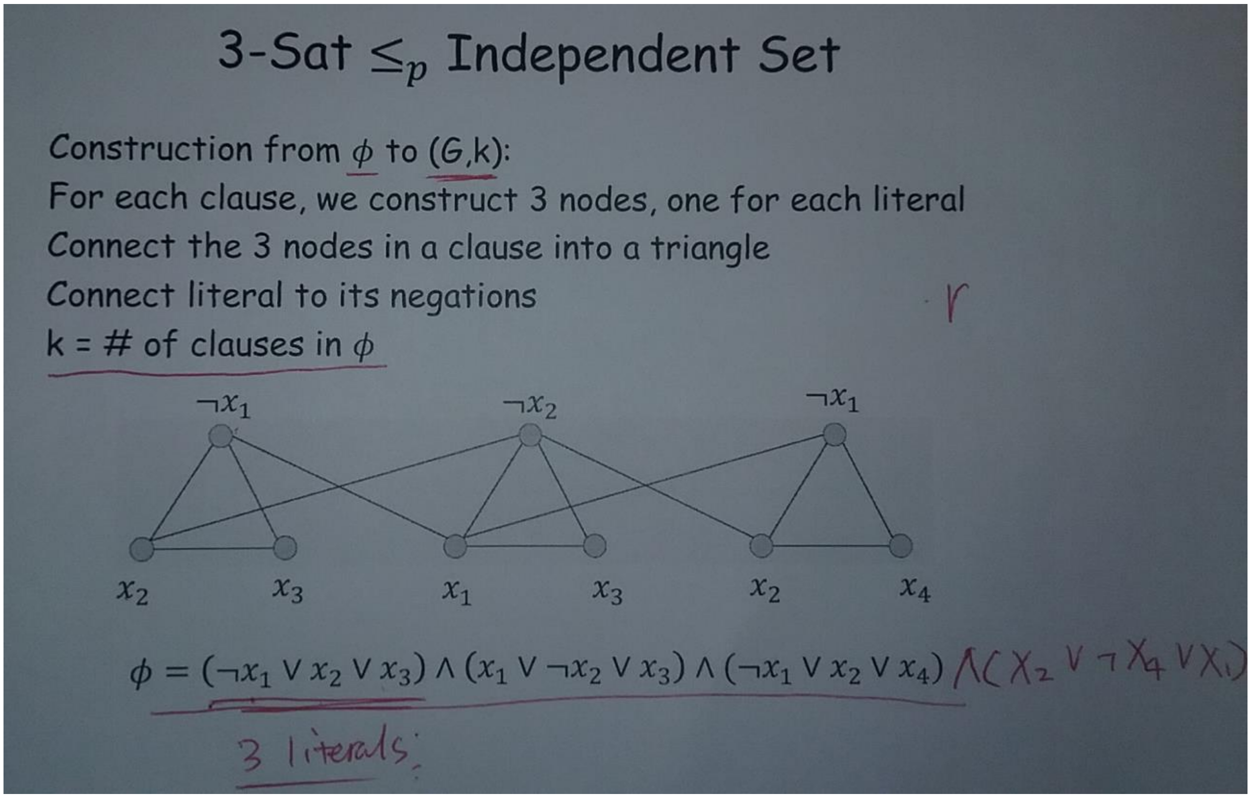
Literal: Boolean variable or its negative x or -x

Clause: A disjunction of Literals:

Conjunctive Normal Form (CNF): a formula that consists of clauses:

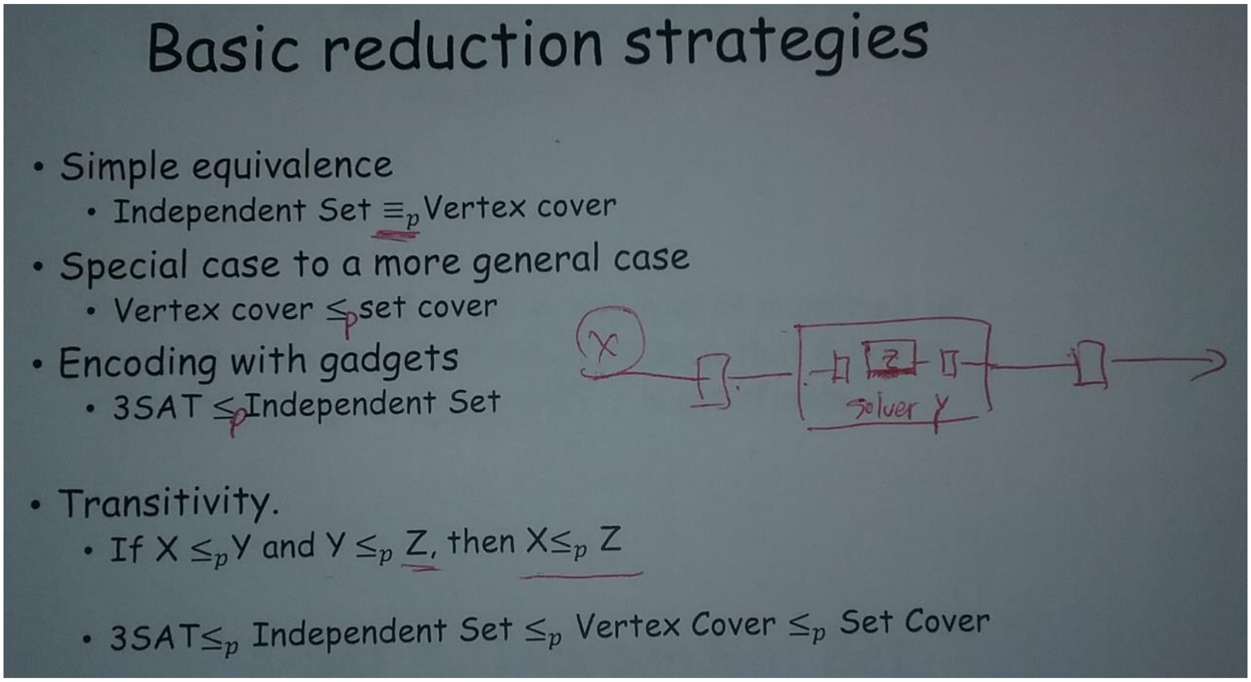
3-SAT: meaning that each clause has 3 Literals.

Reducing 3-SAT into Independent Set:



- Drawing the Literals of the 3-SAT (Picture)
- Connect all elements within a Clause.
- Connect all Literals with their Negations across Clauses.
- Every clause contributes one Literal from Each Triangle (Clause)
- You can only pick one Literal for each Independent Set.
- If you pick the same Literal for different Clauses they have to both be true or both false.
- We can construct this graph in $(3n)^2$. Polynomial time.

Basic Reduction Strategies:



- **Transitivity:**
- If X reduces to Y and Y Reduces to Z. Than X reduces to Z.
- Order of reduction:3SAT <= Independent Set <= Vertex Cover <= Set Cover

Search Vs. Optimization:

Optimization: Find the smallest Vertex Cover.

Search: Find a Vertex Cover of Size <=k

Decision Problem: Is there a vertex Cover of Size <= k.

Next Time:

- No Lecture Tuesday (There will be an online lecture uploaded)
- Next Thursday possible Final review if we get through all material.
- Implementation 2 Grades have been posted.
- Implementation 3 Due next Thursday.

- <u>**End of Week 9 Day 2 Notes**</u>

- ~Information composed by Notetaker Scott Russell for CS 325 **DAS** students