Theorem: NP-completeness: Emotional from SAT thru specific cases of 3SAT, etc.
- improved cigs per ind, set, etc. Reason his best at any prod

CircSAT <= 3SAT reduction:

$G_1 = S_1, \quad \ldots, \quad G_n = S_n$ (where $G_i$ are variables)

$\text{3SAT}$ instance:

$\exists x_1, x_2, \ldots, x_n$ such that

$G_1 \lor \neg G_2 \lor G_3, \quad \neg G_1 \lor G_2 \lor G_4, \quad \neg G_2 \lor \neg G_3 \lor G_5, \quad \neg G_3 \lor \neg G_4 \lor G_6$

If we can solve $3SAT$ in time $(2^{\text{poly}})$ then CircSAT in time $2^{\text{poly}}$.

So want $3 = \text{poly}$.

Counter: if we can find an $\text{aig}$ for $3SAT$ then $\text{aig}$ time $2^{\text{poly}}$.

Problem: circ SAT.

ETM: maybe such an $\text{aig}$ does not exist; $3 \leq 5$. No $2^{\text{poly}}$ $\text{aig}$ for $3SAT$.

- interesting time, 1 or 5.

- can get such even if other promise linear or many solutions.

Best known $3SAT (\text{us SAT})$ aig
- Aig based on simple removal. Prob: error. E.g. in size $2^{\text{poly}}$.
- linear $\text{aig}$ (C1, C2, C3, C4, C5).
- other aigs: same time, different techniques, may be faster, 5x slower.

If it increases, amount scared goes smaller.

$\text{ETM}$ (some exp. time $3^{\text{poly}}$): $\exists z$ such that $\text{aig}$ time $3^{\text{poly}}$.

- interesting time.

- SAT aig were used in practice. Can these or heuristics for $3SAT$ have $3^{\text{poly}}$-time hardness for other, though not $\text{NP}$-hardness.

I. Patrini, Pucklick zone I algorithm: $1, \text{NP}$.

Compress in memory.

1) Read: permute vars. 2) For each var, set it to true, value and set it to false, value.

From previous branch. 3) Iterate of assign $x \in [n]$, which was at area's cost. then.

In fact else set it to false & value.

Then to get if var set's in.
\((U^2V^2) \land (U^2W^2)\). \text{ So, let } U \models x = y \iff x = y \text{ for all } x, y. \text{ For the } i^{th} \text{ set, non-trivial chance to get } c_{ij}, i \leq n \text{ and } j = 1, \ldots, m. \text{ The } c_{ij} \text{ are not independent.} \text{ Suppose } c_{ij} \neq 0. \text{ Then make it non-zero.} \text{ Suppose } c_{ij} = 1. \text{ Let } a \in \mathbb{C} \text{ such that } a \neq 0 \text{ or } a \neq 1. \text{ In this case, } c_{ij} \text{ is the critical value for } j. \text{ Prop } \{X_i \neq j\} \approx \frac{1}{k} \text{ for simplicity, not to do unnecessary complexity. Prop on } c_{ij} \text{ is also important.} \text{ So, if } k \text{ is the number of good decisions is } \frac{k}{n} \text{. Overall } p^{\text{exact}}_k = 2^{-\frac{k}{n}} \approx 2^{-\frac{1}{n}} \text{.} \text{ Given } \text{ non-unique assignment?} \text{ Neighbors are one neighbor over.} \\
\text{Suppose } i \in \mathbb{C} \text{, critical cases are expected to be more common?} \text{ Is } \mathbb{C} \text{ large, also good for } \mathbb{C}. \text{ In } \mathbb{C} \text{ cases see assignments.} \text{ By } \mathbb{C}, \text{ prop } \{X_i = j\} \approx \frac{1}{k} \text{.} \text{ Prop on } c_{ij} \text{ is also important.} \text{ So, if } k \text{ is the number of good decisions is } \frac{k}{n} \text{. Overall } p^{\text{exact}}_k = 2^{-\frac{k}{n}} \approx 2^{-\frac{1}{n}} \text{.} \text{ Let } i = 1. \text{ Each pair has } \mathbb{C} \text{ just in } X_i. \text{ Stable and } Y_i \neq X_i \text{ unless } \text{ const} = 0. S = 2^i. \text{ As } k \text{ gets bigger, so } S = \text{ a set of size } S. \text{ (Sperner's Lemma).} \\
\text{Entropy } H: \text{ measures randomness over } X \text{. } H(X) = \mathbb{E}_X \log \frac{1}{p(x)} \text{ by } \text{ p(x).} \\
H(\{X, Y\}) = \text{ entropy } X \text{ and } Y \text{ of } X \text{ and } Y \text{ of } \text{ exact } \text{ e.g.} \text{.} \\
H(\{X, Y, \ldots, X_i, \ldots, X\}) = \mathbb{E}_X \log \frac{1}{p(x)} \text{,} \text{ p(x).} \text{ Let } X \in S, \text{ if } i \text{ or } X_i \text{ is } \text{ in } \mathbb{H} \text{ or } X \text{ is } \text{ in } \mathbb{H} \text{.} \text{ By } \mathbb{H}, \text{ prop } \{X \in \mathbb{H}\} \text{.} \\
\text{At } X \text{ in } \mathbb{H} \text{ or } \mathbb{H}_0, \text{ prop } \{X \in \mathbb{H}\} \text{.} \text{ If } X \text{ in } \mathbb{H}_0 \text{ or } X \text{ in } \mathbb{H}_0, \text{ no common case.} \\
\text{Prop } \text{ if } X \text{ in } \mathbb{H}_0 \text{ or } X \text{ in } \mathbb{H}_0, \text{ increases } X \text{.} \text{ Since in case } \text{ case, } \text{ case, } \text{ case.} \\
\text{Next case: checking else. Then Sperner's Lemma.}