Today: Circuits (Non-uniform Computation)
Given a graph \( G \), let the graph \( G' \) be obtained by deleting all edges of \( G \). The output \( y \) of the graph \( G' \) is obtained by applying the function \( f \) to each node of \( G' \). Let \( f(x) = \text{AND} \) if \( x \) is connected to at least one node of degree 2. Let \( f(x) = \text{OR} \) if \( x \) is connected to at least one node of degree 1. Let \( f(x) = \text{NOT} \) if \( x \) is not connected to any node.

Define the circuit \( C \) on \( G' \) as follows:

- **Output Node**: \( y \)
- **Input Nodes**: \( x_1, x_2, \ldots, x_m \)
- ** Gates**: All other nodes labeled \( x \)
- **AND Nodes**: Zero in-degree
- **OR Nodes**: One in-degree
- **NOT Nodes**: None

**DAG** with no directed cycles (AND, OR, NOT)
Let any amount of advice

Can have any class \( P \), \( \text{NP} \), \( \text{NP}^c \).

Input & Output

Advice for all
by both, and each
Information that is found

from Uniform Computation

Advice +

Polynomial-Time Circuit

P-time = Computation that can be viewed by

Non-uniform Computation

For Languages \( L \).
NP ≠ P/poly. Not affordable.

\[ \text{If} \ P \neq \ NP, \ \text{then} \ \text{show} \ \#P \neq \ NP \text{by reduction} \]

1) In yes, go, go. "Problem?"

Almoist take "NP" = "P".

\[ \text{Explanation:} \]

if the \ P \ \text{Volunteer} \ \text{some uniform complexity}

\[ \text{Unexplained} \]

NP \neq P/poly? \ \text{？}

2) Unravel \ \text{Haltings} \ / \ \text{P}

\[ \text{Proof: Trivial} \]

\[ \text{Time (TM) = Size (ETM) log TTM) \]}

\[ \text{Proof: TM Kehan} \]

\[ \text{P = P/poly} \]

0

How does new uniformly help & compare with? 

Key Question: 

7
Some $\text{f}(\text{poly}) \rightarrow \text{poly}$ is easy to invert.

Some $\text{NP complete} \rightarrow \text{poly}$. Does not show $\text{NP complete} \rightarrow \text{poly}$. Some $\text{f} \in \text{NP}$ requires large, i.e.

$\frac{u}{v} \leq 2^\frac{1}{n}$

where $\log_2(\frac{1}{n})$.

Therefore $E$ function that requires

$\log_2(\frac{1}{n})$

Number of $u$ bits $\leq 2^v$. Rokach

$E$ function on $u$ bits $\leq 2^v$

Possibilities in all possible children per gate $S_0(5)$.

Label on each node.

Circuit checked by $\geq 2$ wires in each gate.

Circuit $S$ size $= \# \text{Circuits} \& \text{Size} \leq \text{Circuit Lower Bounds}$.
Example

Bipartite - Flow

Node = 1

Data => Tree => Connected & Every

(ex1)

No edge among vertices of the same type.

1. Directly adjacent node
2. Indirectly adjacent nodes

1. Edges are labeled 0/1
2. Out degree 2
3. In degree 0

BP = DAG : Vertices Labeled \(x\) or \(0/1\)

Tree Model 2:

Formulas

Weather: Weaker non-uniiform models with a quadratic

Formal definition:

- \( (\alpha + \text{error}) \)

First 1 to 306 @ (3+\text{error})

Laws and Morison

Share of the art.
Main Theorem: Distinguish function needs $\Theta(n^2)$

\[ \text{Kronecker} \colon \text{Grunt size} \leq O(\text{Grunt size}) \leq O(\text{formal size}) \]

\[ \log n = \max \text{height} \]

\[ \text{Height of layered BP} = \max \text{number of nodes in a layer} \]

\[ \text{Edges from layer i to layer i+1} \]

\[ \text{Layered BP} : \text{Edges} \text{ in each layer} \]
Given $P_B$ for $\text{Domain}$, nothing $h^1$. Where

$$\text{max} \, \text{B.P} \, \text{size}(f_{h^1}) \geq \frac{n}{2}$$

But $\text{B.P} \, \text{size}(f_{h^1}) \leq 1$.

Choose functions $f_{h^1}$ of length $1$. Let

$$f_{h^1} \in \text{Domain} (h^1; h^1)$$

There are many options to $h^1$. At

**Key Property of $B.P.$**: For every $\lambda$,
\[
\frac{\log (n-1)}{2} < 10^a \left( \frac{1}{\sqrt{n-1}} \right) x \leq 52(n) \Rightarrow \text{Pr-nise (f-\#):} \leq 10^b(n^2).
\]