Nov 24 (1)

- Final Exam: Tuesday, Dec 5, LSK 201, 7pm

- Today (Monday) { How not to try to solve P vs. NP
  " maybe " " " " " " "

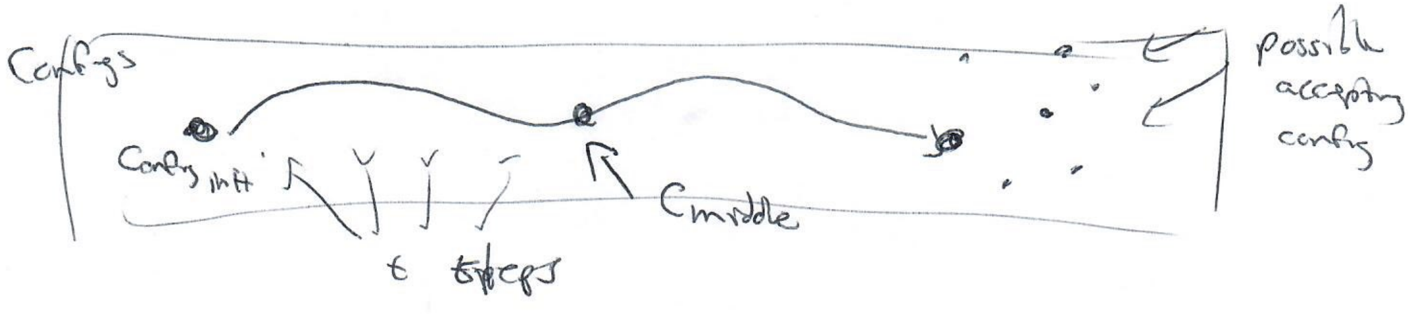
(Ch 9) But really ... { SPACE
Oracles
Cook-Levin idea

Next week:

- More undecidable problems reductions/proofs
- " unacceptable problems " "
- " NP-complete " " "
- review (go over old midterm/final problem)

Chapter 2: CF Languages not covered this year

Last time: To simulate a non-det space s TM algorithm for t time steps: can be done



Upshot: space needed in this deterministic algorithm is $O(s)\,O(\log_2 t)$. If $t \le C_1 s C_2^s \rightsquigarrow O(s^2)$.

Thm: ($\frac{1}{2}$ of Baker-Gill-Solovay Thm):

If B is any PSPACE-complete language, then

$P^B = NP^B$.

Proof: $NPSPACE = PSPACE \subseteq P^B \subset NP^B \subset NPSPACE$

By Savitch's Theorem

definition of B poly space complete

non-determinism can be deterministic

$NP^B = \{L$ recognized by non-det poly time algorithm with a call to oracle $B\}$

Can solve membership in B by poly space algorithm +
Running a non-det poly time algorithm takes no more than poly space } non-det poly space

So $NPSPACE = PSPACE = P^B = NP^B$ ∎

Many theorems in CPSC 421 are true with oracles

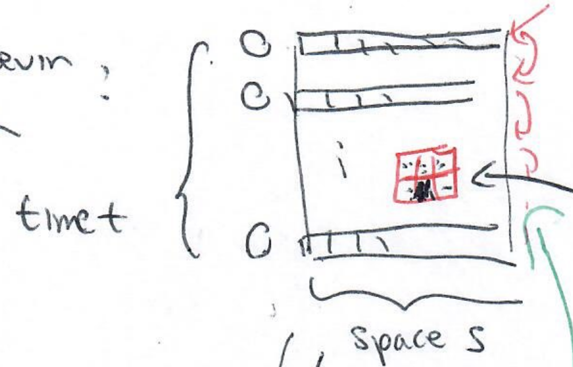
Reductions: B PSPACE-complete : $L \in PSPACE$, $L \leq_{\text{poly time}} B$

B PSPACE-complete $\Rightarrow B \in PSPACE$

Ch 9:

How might you solve P vs. NP :

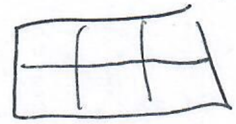
Cook-Levin Thm :



Boolean expression size $\approx O(t \cdot s)$

$t \cdot s$ things to check

at time i, cell j you see a possible scenario, based on time $i-1$, cells $j-1, j, j+1$; time i cells $j-1$, $j+1$



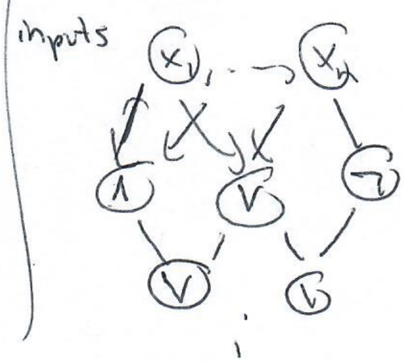
3SAT.

1 SAT is NP-complete

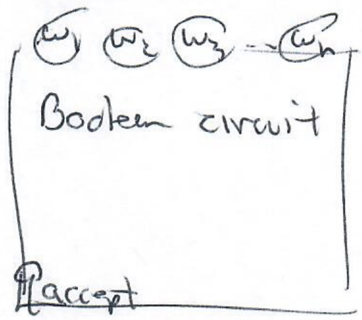
$L \in NP$

2 In a deterministic algorithm, if $L \in P$

Circuit



Create a circuit → input w



$L \in P$, to see if $w \in L$, $w = w_1, \ldots w_n$ there is a circuit of size Order$(t \cdot s)$

Order(poly(n))

If for SAT, a circuit that computes $\nearrow q_{acc}$ / $\searrow q_{rej}$ correctly needs more than poly # gates in a computing circuit, then $P \neq NP$