

Prob 2: DFA (Ch.1, not covered)

Prob 3: Explain 3SAT \rightarrow SUBSET-SUM

reduction:

- can have difficult reduction covered in class

- an easy reduction

2PARTITION = PARTITION \rightarrow 3PARTITION

problems look like

n_1, \dots, n_k

① if n_1, \dots, n_k sum is odd, write string \notin 3PARTITION write 1,1

② $n_1, \dots, n_k, n_{k+1} = \frac{n_1 + \dots + n_k}{2}$

Make sure

$\langle (x_1 \vee \neg x_2 \vee \neg x_3) \wedge \dots \rangle$

SUBSET-SUM Question

$n_1, n_2, \dots, n_k; t$

$\uparrow \uparrow \uparrow \uparrow$
target

must argue that this is poly-time reduction

Reduction: $w \mapsto f(w)$

CPSC 421/501 Dec 2 23

- TA evaluations

Finals 2014, 2011, 2010

2014:

Problem: T.m construction

for $\{0^n 10^n\}$

Explain how machine works

Describe δ :

Can omit δ values never reach

Diagram: $Q_0 \xrightarrow{0,1;R} Q_1$ etc. Q_2

$f = (x_1 \vee \neg x_2 \vee \neg x_3) \wedge$

take 3 SAT n digits $n = \text{vars in } f$

n_1	1	x_1	} $2n$
n_2	1	$\neg x_1$	
1	0	1	} $2n$
1	c	1	
...	} n for each clause
n_k	0	1	
t	1	target	

(2') some NP-complete language \leq BLAH

=

make sure direction is right!

Typically (1) easy

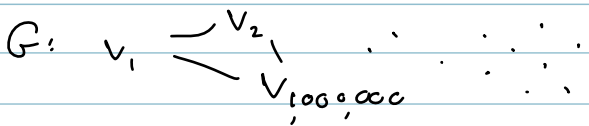
(2), (2') more difficult

Is 3COLOR in NP?

guess for each vertex

a color $\left(\left| \langle G \rangle \right| \geq \frac{\# \text{vertices}}{2} \right)$
 after eliminating isolated vertices from G

$\langle G \rangle = \# \text{vertices}$
 base 10, edge set



$w \in \Sigma_{3CNF}^*$ $f(w) \in \Sigma_{\text{SUBSET-SUM}}^*$ 24

$w \mapsto f(w)$

Convince reader that f is polytime

- can you produce $f(w)$ from w in polytime:

- we write n_1, \dots, n_k, t
- produce each n_i in polytime, make sure $k \leq \text{poly}(|w|)$

Ask: is BLAH NP-complete?

(1) BLAH is in NP

(2) if $L \in \text{NP}$, $L \leq \text{BLAH}$

NP-EASY

$= \{ \langle M, i, t \rangle \mid \begin{array}{l} \text{non-det} \\ M \text{ is T.m.} \\ i \text{ input} \\ t = \text{time in unary} \end{array} \}$

i.e. $\{ \langle M, w, t \rangle \}$

This an exception:

based on universal T.m. show NP-EASY \in NP is tricky

but $L \in \text{NP}$ and show $L \leq \text{NP-EASY}$ is quite easy

2014 final:

Problem 4: DOUBLE-SAT =

$\{ \langle f \rangle \mid f \text{ Boolean formula with at least 2 satisfying assignments} \}$

show NP-complete

(1) DOUBLE-SAT \in NP?

(2) SAT \leq DOUBLE-SAT

Many possibilities

5 (d) Show that NP-EASY is NP-complete with embellishments.

Usual office today & tomorrow

3-5pm Friday: Alineza Z.H.
(review)

3-5pm Monday: Joel F.
& Alineza Z.H. (problems)

cabon TBA