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

Prob 3: Explain 3SAT → SUBSET-SUM reduction:

- can have difficult reduction covered in class

- an easy reduction

2PARTITION = PARTITION → 3PARTITION

problems look like

$n_1, \ldots, n_k$

① if $n_1, \ldots, n_k$ sum is odd, write string $\notin$ 3PARTITION: write 1, 1

② $n_1, \ldots, n_k, \; n_{k+1} = \frac{n_1 + \cdots + n_k}{2}$

- TA evaluations

Finals 2014, 2011, 2010

2014:

Problem 1: T.m construction for $\{0^n 1 0^n\}$

Explain how machine works

Describe δ:

Can omit δ values never reach

Diagram: $q_0 \xrightarrow{0;1;R} q_1$ etc.

q_2

Make sure

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

SUBSET-SUM question

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

target

must argue that this is poly-time reduction

Reduction: $w \rightarrow f(w)$

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

$\ldots$

take 3SAT

n = vars in f

one digit for each clause; n digits

n_1, n_2, …, n_k; t

x_1: 1, $\neg x_1$: 1, …: 0, 0 — $2n$

3CNF clauses: 0 — n for each clause

t: 1 — target

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(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

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

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

G: v_1 — v_2, v_1 — $v_{1{,}000{,}000}$

$w \in \Sigma^*_{3CNF}$ $\quad f(w) \in \Sigma^*_{SUBSET\text{-}SUM}$

$w \rightarrow f(w)$

Convince reader that f is polytime

- can you produce f(w) from w in polytime:
  - we write $n_1, \ldots, n_k, t$
  - produce each n_i in polytime, make sure $k \leq poly(|w|)$

Ask: is BLAH NP-complete?

(1) BLAH is in NP

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

NP-EASY

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

i.e. $\{ \langle M, w, 1^t \rangle \}$

This an exception:

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

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

2014 Final:

Problem 4: DOUBLE-SAT =

$\{ \langle f \rangle \mid$ f 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) with embellishment: Show that NP-~~EASY~~ EASY is NP-complete

Usual office today & tommorow

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

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

location TBA