CPSC 421/501
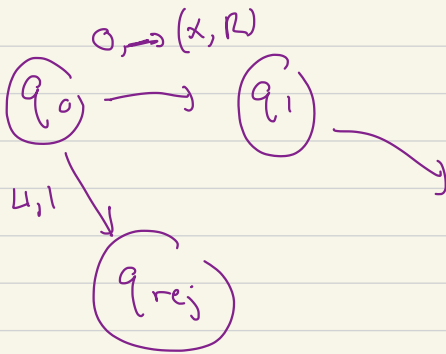
There is a final Exam 2020 webpage

2.

$L = \left\{ x \mid \begin{array}{l} \text{(1) } x \text{ begins } 0 \\ \text{(2) } x \text{ has two more } 0\text{'s than } 1\text{'s} \end{array} \right\}$

$L = \{ \ldots, \ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0 \ , \ - - - $

$0 \longrightarrow (x, R)$

$q_0 \longrightarrow q_1$

$1, 1 \searrow$

q_{rej}

$0\ 0\ 0\ 1\ 0\ 1$
$\downarrow$
$x\ 0\ 0\ 1\ 0\ 1$
$\underline{x\ y\ 0\ 1\ 0\ 1\ \sqcup}$

search for 0
turn to y

$\downarrow$

go thru form x to $\sqcup$
each left right pass

q saw 0 q saw 1
but not 1 but not 0

$\downarrow$ 0
turn both into y's

NP completeness ⓪ Read carefully description of L

① Argue that the language is NP complete

② Make sure your reduction goes the wright way:

SUBSET-SUM ～～～⟶ instance of
instance L

$n_1, \dots, n_k, m, t$ s.t.
(pos integers), $\exists \, \bar{I}, \bar{J} \subset [k]$
s.t.

$$\sum_{i \in \bar{I}} n_i + m \left(\sum_{j \in \bar{J}} n_j \right) = t$$

$\left(a_{1, \dots}, a_r \, ; \, b \right)$ ～～～⟶

Subset sum

$$B = a_1 + \dots + a_r + 1$$

write $\boxed{a_{11} \quad a_{21, \dots}, \quad a_r, B, B \cdot b}$

$m \left(\substack{\text{sum of} \\ a's} \right) + B \left(\substack{\text{sum of} \\ a's} \right) = B \cdot b$

$< B$

multiples of B

$(<b) +$ multiple $=$ other multiple
of B of B

0

same

$$B\left(\sum_{j \in J} a_j \right) = B b$$

$$\sum_{j \in J} a_j = b$$

$L = \{ \ldots, 0001 0110, \ldots$

q_0 $0 \longrightarrow (x, R)$ q_1

$4, 1$

q_{rej}

q search for 2nd 0

$0 \to (y, L)$

$x \mid 1 \, 0001 \ldots$

$x \mid 1 \, y \, 0 c 1 \ldots$

$0, 1$

$x \mid \to R$

y

$x \mid 1 \, y \, 0 c 1 \, \ldots \ldots \, 0 \, 1 \, \sqcup \sqcup$

(x, R)

$0, 1, y \to L$

with $1, 0$ exchanged

$0001 c 1$
$x \, 0 c 1 0 1$
$x y 0 1 c 1 \sqcup$

$x 0 0 1 0 1 \sqcup$

search for 0
turn to y

go thru form x to $\sqcup$
each left right pass

q saw 0 but not 1 q saw 1 but not 0

$\overset{0}{\longrightarrow}$

turn both into y's

$\sqcup \to q_{accept}$

$1 \to (y, R)$

$0 \to (, R)$

q saw a 1
haven't yet seen 0
need to see 0

$1 \to R$ q_{rej}

$0 \to y, L$