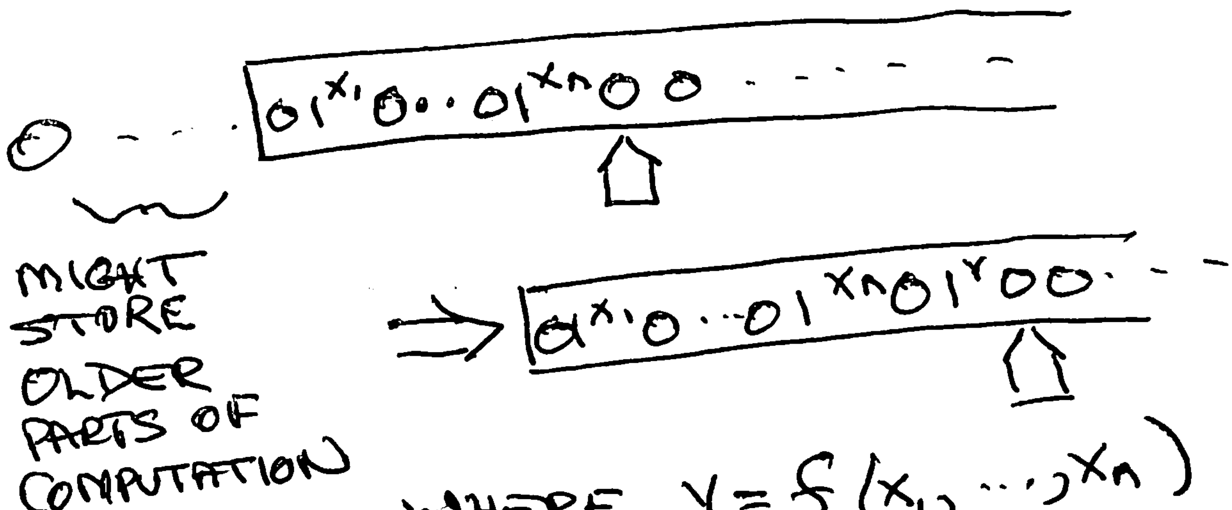
10/25/2016

HELP SESSION FRIDAY
4:00 – 6:00 PM
MSB 360
(MATH-SCIENCE)

NO ROOM AVAILABLE FOR
NEXT WEDNESDAY
BUT SINA WILL HAVE
OFFICE HOURS
10:00AM – NOON

EXAM SAMPLE LINKED OFF HOME PAGE

STANDARD TURING COMPUTING



WHERE $Y = f(x_1, \ldots, x_n)$

COMPOSITION IS EASY WITH THIS APPROACH TO COMPUTATION

SOMETIMES CALLED SEMI-UNBOUNDED TAPE

NOTE THAT TAPE IS ALWAYS FINITELY MARKED. CAN HAVE INSTANTANEOUS DESCR. (ID) AS TRIPLET (L, R, STATE)

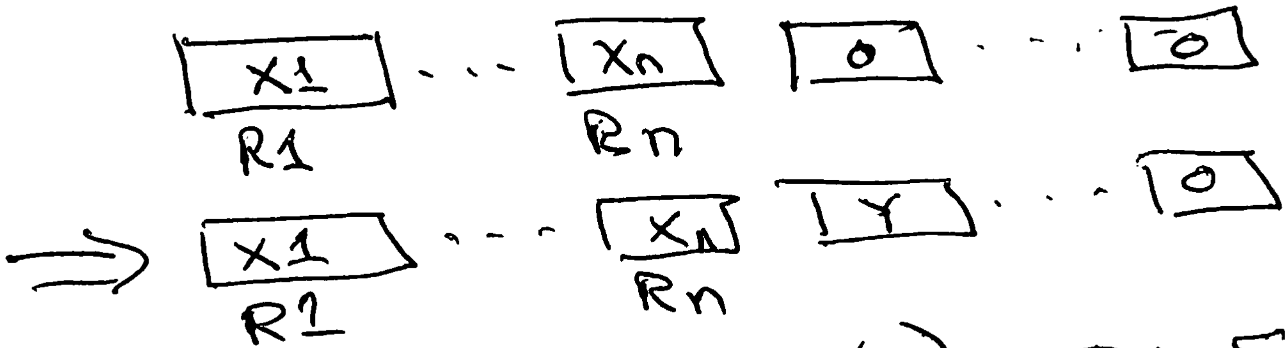
…0110 10110…
$q_3 \rightarrow$ ⇧ $\langle 6, 13, 3 \rangle$

WHERE L IS # DENOTED BY BINARY VALUE OF LEFT OF SCANNED SQUARE; R IS # DENOTED BY RIGHT AND SCANNED, READ RIGHT TO LEFT; STATE IS STATE #

10/25/2016

REGISTER MACHINES

MY STANDARD COMPUTATION



WHERE $Y = f(x_1, \ldots, x_n)$

$j.\ INC_k[i]$

$j.\ DEC_k[p, z]$

(p ↑ SUCCESS, z ↑ FAIL)

ALTHOUGH WON'T SHOW, CAN MIMIC TM BY STORING ID IN 3 REGISTERS

CAN EVEN CREATE PROLOGUE THAT STARTS AS ABOVE AND CREATES THAT 3 REGISTER ENCODING

CAN HAVE EPILOGUE THAT EXTRACTS ANSWER FROM TRIPLE AT END OF SIMULATION

ID IS JUST $\langle R1, R2, \ldots, Rk, STATE \rangle$ PAIRING

OR $3^{R1} 5^{R2} \cdots p_k^{Rk}\ p_{k+1}^{STATE}$

Factor Replacement System

$3^{x_1} \cdots p_k^{x_k} \Rightarrow 2^y$

$y = f(x_1, \ldots, x_k)$

$3^4 5^2$
$\Rightarrow 2 3^3 5^2$
$\Rightarrow 2^2 3^2 5^2$
⋮

$3x \to 2x$
$5x \to 2x$

$2^4 5^2$
$2^5 5$
2^6

2/3 OR
2/5 OR
$3^x 5^y \overset{*}{\Rightarrow} 2^{x+y}$

1/3.5 OR
2/3
2/5 1/5
$3^x 5^y \overset{*}{\Rightarrow} 2^{MAX(x-y,0)}$

$15x \to x$
$3x \to 2x$
$5x \to x$

a_1/b_1
a_2/b_2
⋮
a_k/b_k

$b_1 x \to a_1 x$

$b_k x \to a_k x$

10/25/2016

REGISTER TO FRS

REGISTERS

STORE AS POWERS OF PRIMES

STORE STATE AS POWER OF NEXT PRIMES

PRESENCE IS EASY ($R_k > 0$)

P_k

STATE CHECK IS EASY

P_{n+s} WHERE n REGISTERS

m. DEC k[i,j]

ORDER $\begin{cases} P_k P_{n+m} X \to P_{n+i} X \\ P_{n+m} X \to P_{n+j} X \end{cases}$

m. INC k[i]

$P_{n+m} X \to P_k P_{n+i} X$

IsPowerOf2

$3^2 \cdot 5x \rightarrow 5 \cdot 7x$ // ITERATIVELY DIV BY 2

$3 \cdot 5 \cdot 7x \rightarrow x$ // CAME UP ODD

$3 \cdot 5x \rightarrow 2x$ // CASE OF $1 = 2^0$

$5 \cdot 7x \rightarrow 7 \cdot 11x$ // WAS DIV BY 2

$7 \cdot 11x \rightarrow 3 \cdot 11x$ // GET READY TO DIVIDE BY 2 AGAIN

$11x \rightarrow 5x$ // GO UP TO DIVIDE BY 2

$5x \rightarrow x$ // CASE OF 0

$7x \rightarrow x$ // CLEAN UP ODD CASE

$3^{2x}5 \rightarrow 7^x5 \rightarrow 7^x11 \rightarrow 3^x11 \rightarrow 3^x5$

$\ldots \rightarrow 3^1 5 \rightarrow 2 = 2^1$

$3^{2x+1}5 \rightarrow \ldots 3 7^x 5 \rightarrow 7^x \rightarrow 1$

$3\,5 \rightarrow 2 = 2^1 \; (3^1 5)$

$5 \rightarrow 1 = 2^0 \; (3^0 5)$