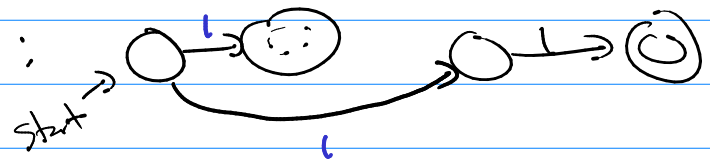
Math 322

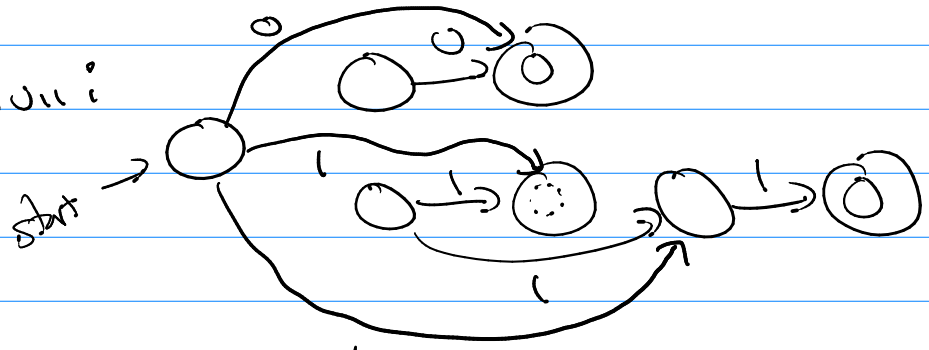
Q3/ 13.4 (13b) $(0 \cup 11)^*$

M_0: start → ○ —0→ ◎ M_1: start → ○ —1→ ◎

M_{11}:



$M_{0 \cup 11}$:



$M_{(0 \cup 11)^*}$:

$(\ )^* = [(\ )^0][(\ )^1], (\ )^2, (\ )^3, \ldots$

13.5 (#20) Make turing machine = find 5-tuples

$f(n) = n \bmod 3$ on $n = 0, 1, 2, 3, \ldots$

$0 \bmod 3 = 0$ $\quad 3 \bmod 3 = 0$ $\quad \ldots$

$1 \bmod 3 = 1$ $\quad 4 \bmod 3 = 1$

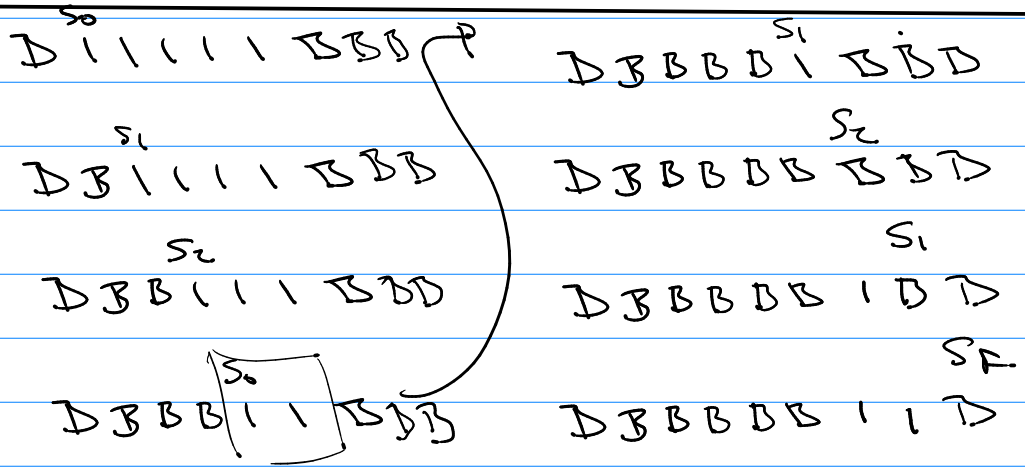
$2 \bmod 3 = 2$ $\quad 5 \bmod 3 = 2$

0 = 1 2 = 111
1 = 11 3 = 1111 ...

	input	output
Ex:	0 mod 3 = 0	1
	1 mod 3 = 1	11
	2 mod 3 = 2	111
	3 mod 3 = 0	1
	4 mod 3 = 1	11
	5 mod 3 = 2	111
	6 mod 3 = 0	1

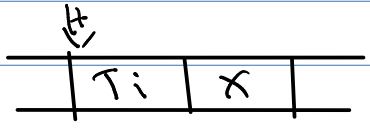
5 mod 3 = 2 b/c 5 = (1) 3 + 2
7 mod 3 = 1 b/c 7 = (2) 3 + 1

$\Delta = \{(S_0, 1, S_1, B, R), (S_0, B, S_2, 1, R),$
$(S_1, 1, S_2, B, R), (S_1, B, S_4, 1, R),$
$(S_2, 1, S_0, B, R), (S_2, B, S_1, 1, R)\}$



Halting Problem: ? Does a Turing machine exist

such that on a tape



H → output 1 if $T_i(x)$ halts

→ output 0 if $T_i(x)$ loops

Halting problem = Does H exist?

Note: given a problem and you have a Turing machine that solves it → Solvable

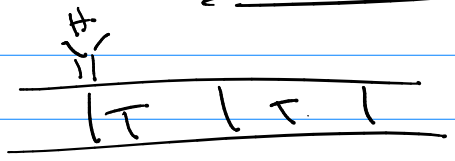
& not → not solvable (unsolvable problem)

Thm Halting problem is unsolvable.

Pf by contradiction

① Assume H exists.

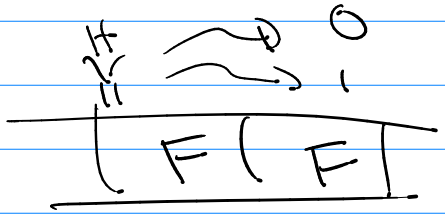
② New machine Flipper Turing.



H(T,T) → 1 H halt
→ 0 loop

F(T) = 1 if H(T,T) = 0
= 0 if H(T,T) = 1

③ F(F) → 0 → 1



leads to a contradiction.

F(F) = 0
F(F) = 1