Church: μ-recursive

$0, \sigma, \pi_i^k$ 0, PR, μ-rec → high-level.

for loop, while loop.

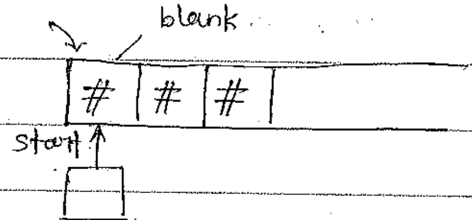
Turing: Turing machine] → low level.

Can we compute every μ-recursive fn on a Turing m/c?

In unary code, 0

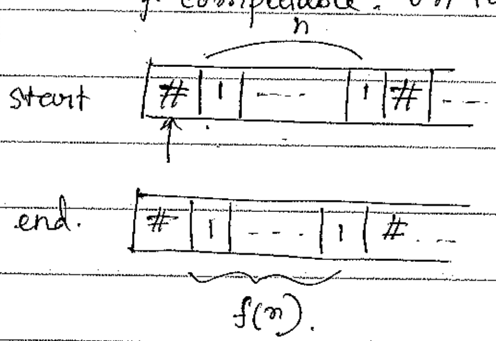
1	1
2	11
3	111

~~[There is start state &~~ halt-state in turing m/c.]



~~* (here we are building the~~ turing m/c where the pointer doesn't ~~fall off the clip.)~~

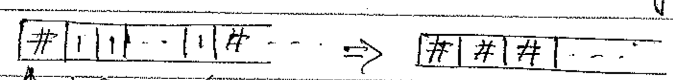
f computable on turing m/c if there exists a turing m/c with the following property.



Starts with value n (state)

& end up with state f(n)

how 0 is represented? 0 means nothing on tape



Start. These are states which are blank for '0'

* since the pointer doesn't fall off, when $\frac{\text{state}}{1}$ gets over then rewinds back & erase, & when nothing to erase then halts.

Algorithm :- (start, #) → (R, reading)

(reading, 1) → (R, reading)

(reading, #) → (L, erasing)

(erasing, 1) → (L, #, ")

(erasing, #) → halt

(1) |#|1|1|#| start

(2) |#|1|1|#| reading

(3) |#|1|1|#| reading

(4) |#|1|1|#| reading.

(5) |#|1|1|#| erasing

(6) |#|1|#|#| erasing

(7) |#|#|#|#| erasing

(8) |#| - halt

when we have '0'

|#|#| start → |#|#|- reading → |#|#| erasing ⟶ |#|#| halt.

so, '0' is turing computable

when 6. (with unary notation : $\overset{(2)}{11} + \overset{(1)}{1} = \overset{(3)}{111}$)

|#|1|1|#| start.

(start, '#') → (R, reading)

(Reading, 1) → (R, ")

(" , #) ⟶ (1, L, back) → here we are adding 1 & going back.

(back, 1) ⟶ (L, back)

(" , #) ⟶ halt.

here adding 11 & 1.

|#|1|1|#|- - start → |#|1|1|#| reading → |#|1|1|#|- reading → |#|1|1|#| reading

|#|1|1|1| back ⟶ |#|1|1|1|#| back ⟶ |#|1|1|1|#| back ⟶ |#|- - halt

So, 6 is turing computable.

1. h.w. design a turing m/c that computes. $f(n) = n+2$.
2. π_1^3.
3. $\pi_2^2 \quad (n_2, n_2) \to n_2$

If adding with 0 & 1

|#|#| start → |#|#| Reading → |#|1| back → |#|1| halt.

Projection. $\pi_1^2 = (n_1, n_2) \to n_1$

$\overbrace{|\#|1|1|1|}^{n_1}\#\overbrace{|1|1|}^{n_2}|\#|$

↓

$\overbrace{|\#|1|1|1|}^{n_1}\underbrace{\#|\#|\#|\#|}_{\text{erase } n2}$

in1right.

(start, #) → (R, ~~reading~~ in1right)

(~~Reading~~ in1right, 1) → (R, ~~reading~~ in1right)

(in1right, #) → (R, in2right)

(in2right, 1) ⟶ (R, in2right)

(in2right, #) → (L, erase2)

(in2right, 1) → (#, L, erase2)

(erase2, #) ⟶ (L, in1left)

(in1left, 1) → (L, in1left)

(in1left, #) → halt.

starting with