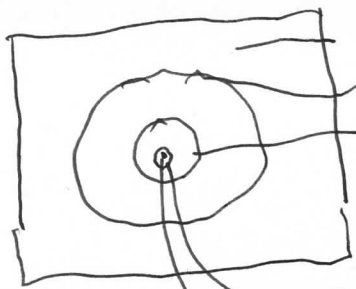


미15주 - 리. Rice's & Cook's Theorem

Review!



non-RE (undecidable) type-1
 R.E but not recursive type 0
 recursive (decidable) type 1

non RE (") \nexists prog. L_d, L_e
 RE but undecidable \exists prog. L_u, L_{ne}
 recursive (decidable) \exists prog. & term.

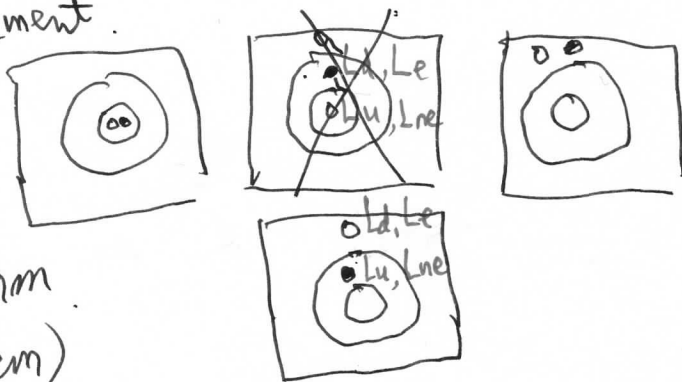
c.f. - type 2
 regular type 3
 (finite)

* Diagonalization
 (w_i, M_i)

$$L_d = \{w_i \in \Sigma^* \mid w_i \notin L(M_i)\} \text{ --- Denial of Self rec.}$$

$$L_u = \{w_i \in \Sigma^* \mid w_i \in L(M_i)\}$$

* Complement



Reduction
 $P_1 \geq P_2$

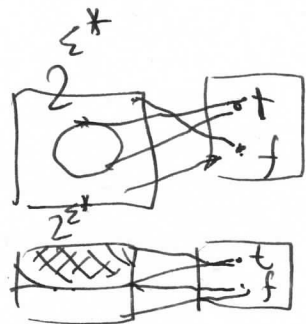
* Rice's Thm

문제 (problem)
 C.F.L.

$$P: 2^{\Sigma^*} \rightarrow \{t, f\} \dots \text{언어에 대한 클래스에 관한 문제는}$$

$$P = \{L \subseteq \Sigma^* \mid P(L)\} \iff P = \{M \in TM \mid L(M) = L\}$$

TM에 관련된 문제는 모두 undecidable 이다.



(인어. \exists 증명)
 <proof>

non-trivial
 $\emptyset, 2^{\Sigma^*}$
 $\{t\}$
 $\{f\}$

no-instance 가 $\{t\}$ 이거나 $\{f\}$ 가

Proof (Thm 9.11)

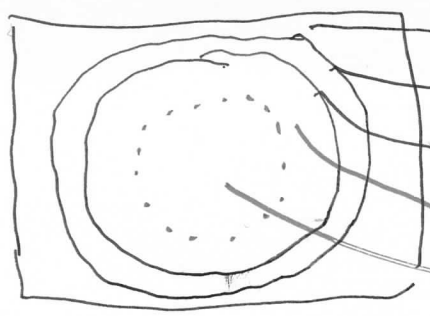
1. case 1

- 1) U simulate w for M.
- 2) M accept w
- 3) M_L simulate for ∞ .

2. case

$\emptyset \in P$. $\emptyset \notin P$ 이하 등문

Reduce L_u to L_p $L_u \leq L_p$.



non-R.E. (non-programmable)
 R.E. (programmable)
 recursive (decidable, terminate algorithm)
 intractable - exponential
 tractable - polynomial (다항식)

$O(n^{6.92 \times 10^{23}})$ vs $O(2^n)$

$|N^k| = |N| \cdot \frac{5}{2} \frac{2^k}{k}$
 $|2^N| > |N| \cdot \frac{5}{2} \frac{2^N}{N}$

NP ... Nondeterministic Polynomial $O(p(n))$

예) CFL ~~NP~~ left parser right parser (NL: Nondeterministic Linear) $O(n)$
 membership 문제를 해결하는

⊗ CYK algorithm - $O(n^3)$

NP이지만 P이다.

NP ~~문제~~ alg.의 worst case solution Exp.
 Decision tree



$p(n)$

k paths $P(n)$

NP 문제는 P인지 Exp인지 모른다. 느껴 풀리는
 NP-complete ... NP-강 ... NP 중 제일 어려운 문제.

만일 NP-강은 P로 해결하면, 모든 NP는 P이다

정의 NP-complete 문제 ~~NP~~ P

- 이 문제 P를 해결하는 NP alg.를 찾았지.
- $\forall P' \in NP$ (모든 NP alg.이 갖는 P')에 대해 $P' \leq_{PTR} P$ 증명하여야 한다.

SAT 문제 - n 변수 \wedge, \vee, \neg , boolean logic \Rightarrow SAT가 NP-complete의 첫 번째 예.
 모든 NP 문제 $P' \leq_{PTR} SAT$.