

# Relation 관계

: 객체들 간의 연관성 표현

• A와 B가 서로 관계가 있는 경우

$$- A \subset B \text{ OR } B \subset A$$

$$- A = \bar{B} \text{ OR } \bar{A} = B$$

• 관계를 표현하는 대표적인 방법: 이항 관계

$$- a, b \text{ 관련 } 0) a R b \Leftrightarrow (a, b) \in R \subset A \times B$$

$$- \text{ " } X) a \not R b \Leftrightarrow (a, b) \notin R \subset A \times B$$

## 그래프

• 경로(path): 같은 간선을 중복하지 않게 거치는 경로

• 단순  $\square$ : 정점 중복 X

## 오일러 정리.

$$\text{꼭짓점수} - \text{연결선수} + \text{면수} = 2$$

in 평면 그래프

## 트리

레벨: 0부터 시작

높이:  $\max(h_1 \sim h_n)$

동치관계 대표예시: mod 합동

$$x \equiv y \pmod{m}$$

$$\cdot \text{반사: } A \equiv A \pmod{C}$$

$$\cdot \text{대칭: } A \equiv B \pmod{C} \rightarrow B \equiv A \pmod{C}$$

$$\cdot \text{추이: } A \equiv B \pmod{D}, B \equiv C \pmod{D} \rightarrow A \equiv C \pmod{D}$$

함수  $f: S_1 \rightarrow S_2$

• 정의역  $\subseteq S_1$ , 치역  $\subseteq S_2$

• 관계의 제한적인 상태: 정의역 원소는  $\rightarrow (x, y) \in f$   
한번만 사용가능  $(x, z) \in f$   
 $\Rightarrow y = z$

• 전역함수: 정의역  $= S_1$

• 부분함수: 정의역  $\subset S_1$

• 공함수: 정의역  $= \emptyset$

• Equal: 정의역, 공범역,  $\forall x \in \text{정의역}, f(x) = g(x) \rightarrow f = g$

- 공리: always TRUE proposition
- 정의: 논리의 대상의 의미, 내용을 뚜렷이 규정한 문장, 식
- 정리: 공리 + 정의로 TRUE가 확인된 proposition
- 증명: 공리 가정 후 어떤 명제가 참이라는 것을 보이는 것

$$\bullet \quad n=0) \quad \frac{0 \cdot 1}{2} = 0 = S_0$$

$$n=k) \quad \frac{k \cdot (k+1)}{2} = S_k \quad \text{가정}$$

$$n=k+1) \quad \frac{k \cdot (k+1)}{2} + (k+1) = \frac{k \cdot (k+1) + 2(k+1)}{2} = \frac{(k+1)(k+2)}{2} = S_{k+1}$$

$$\bullet \quad n=0) \quad \text{루트노드 한개 존재} \quad 1 \leq 1$$

$$n=k) \quad l(k) \leq 2^k \quad \text{가정}$$

$$n=k+1) \quad l(k+1) = 2l(k) = 2^{k+1}$$

$$\bullet \quad \sqrt{2} = \frac{n}{m}$$

$$\Rightarrow 2m^2 = \underbrace{(n^2)}_{\text{짝수}} \Rightarrow n \text{도 짝수}$$

$$\Rightarrow n=2k) \quad 2m^2 = n^2 = 4k^2$$

$$\Rightarrow m^2 = 2k^2 : m \text{도 짝수}$$

$$\therefore \text{즉 } n, m \text{은 서로소가 아니다.}$$

$$M = (Q, \Sigma, \delta, q_0, F)$$

↑  
상태  
↑  
알파벳  
↑  
함수  
↑  
초기  
상태  
↑  
최종  
상태

$$M = (\{q_0, q_1\}, \{a, b\}, \delta, q_0, q_1)$$

$$\text{where } \delta : \delta(q_0, a) = q_1, \delta(q_0, b) = q_0$$

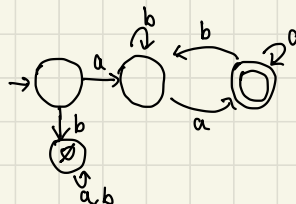
$$\delta(q_1, a) = q_1, \delta(q_1, b) = q_0$$

$$L(M) = \{w \in \Sigma^* : \delta^*(q_0, w) \in F\}$$

$$L = \{w \mid w \in \{0,1\}^* 001011^*\}$$

$$L = \{w \mid w \in \{a^n b\}, n \geq 0\}$$

$L = \{awa \mid w \in \{a, b\}^*\}$  is 정규 언어?



$$\lambda\text{-closure}(1) = \{1, 3, 4\} = A$$

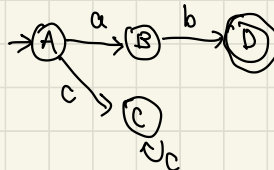
$$Q \quad a\text{-successor}(Q) \quad b\text{-}\lambda(Q) \quad c\text{-}\lambda(Q)$$

$$A \quad \{2\} = B \quad \emptyset \quad \{3\} = C$$

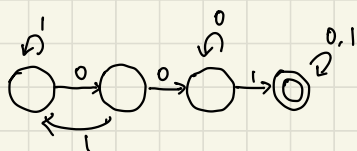
$$B \quad \emptyset \quad \{4\} = D \quad \emptyset$$

$$C \quad \emptyset \quad \emptyset \quad C$$

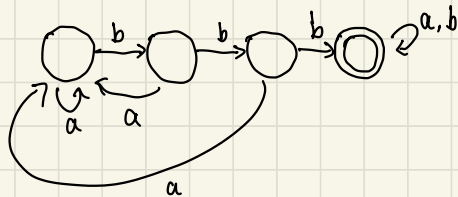
$$D \quad \emptyset \quad \emptyset \quad \emptyset$$



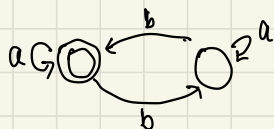
부분자열 001 인식



" bbb 인식

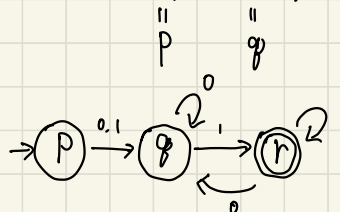


자식자녀 b



$$\text{For } \equiv^0 : (A, B, D) (C, E)$$

$$\text{For } \equiv^1 : (A) (B, D) (C, E) : \text{등치 클래스}$$



$$\cdot L = \{w \in \{0,1\}^*; \exists n \leq 0 \times \}$$

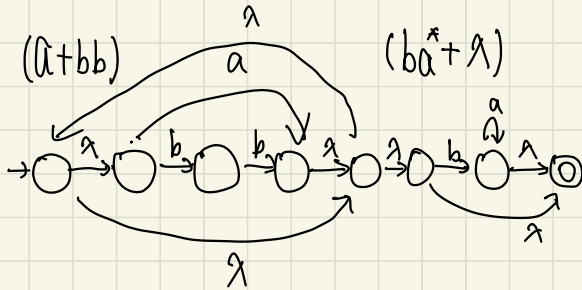
$$\rightarrow r = (1+01)^*(0+\lambda)$$

$$\begin{aligned} \cdot (r+s)^* \\ &= (r^* + s^*)^* \\ &= (r^* s^*)^* \\ &= r^* (s r^*)^* \end{aligned}$$

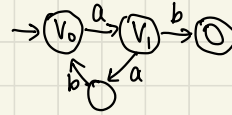
$$\begin{aligned} S &\rightarrow aS \mid bR \mid \lambda \\ \Rightarrow S &= aS + bR + \lambda \\ &= aS + baS + \lambda \\ &= (a+ba)S + \lambda \\ &= (a+ba)^* \end{aligned}$$

$$\begin{aligned} R &\rightarrow aS \\ \Rightarrow R &= aS \end{aligned}$$

$$\begin{aligned} \cdot a^* b a^* b (a+b)^* : \text{FIFO} \\ (a+b)^* b (a+b)^* b (a+b)^* \end{aligned}$$



$$\begin{aligned} V_0 &\rightarrow aV_1 & V_0 &\rightarrow aabV_0 \mid ab \\ V_1 &\rightarrow abV_0 \mid b & & (aab)^* ab \end{aligned}$$



$$\cdot ac(a+b) : S \rightarrow acA \\ A \rightarrow a \mid b$$

$$\cdot a^* b : S \rightarrow aS \mid b$$

$$\cdot a^* : S \rightarrow aS \mid \lambda$$

$$\cdot (a+b)^* : S \rightarrow aS \mid bS \mid \lambda$$

$$\cdot a(a+b)^* : S \rightarrow S(a+b) \mid a$$

$$\begin{aligned} \cdot (ab)^+(a+d) &= (ab)^*(ab)(a+d) \\ &= (ab)^*(aba+abd) \end{aligned}$$

$$: S \rightarrow abS \mid aba \mid abd$$

$$\begin{aligned} \cdot aab^*a : S &\rightarrow aaA & S &\rightarrow Aa \\ A &\rightarrow bA \mid a \text{ OR } A &\rightarrow aa \mid Ab \end{aligned}$$

$$\begin{aligned} \cdot \{a^n \mid n \geq 0\} \cup \{b^n a \mid n \geq 1\} &\Rightarrow S \rightarrow S_1 \mid S_2 \\ &= a^* + b^* b a \\ S_1 &\rightarrow aS_1 \mid \lambda \\ S_2 &\rightarrow bS_2 \mid ba \end{aligned}$$

$$\cdot a^* + bc^*d$$

$$S \rightarrow S_1 \mid S_2$$

$$S_1 \rightarrow aS_1 \mid \lambda$$

$$S_2 \rightarrow bS_3$$

$$S_3 \rightarrow cS_3 \mid d$$

$$\cdot S \rightarrow S_1 ab \quad \rightarrow S = S_1 ab \quad ①$$

$$S_1 \rightarrow S_1 ab \mid S_2 \quad \rightarrow S_1 = S_1 ab + S_2 \quad ②$$

$$S_2 \rightarrow a \quad \rightarrow S_2 = a \quad ③$$

$$③ \rightarrow ② : S_1 = S_1 ab + a = a(ab)^* \quad ④$$

$$④ \rightarrow ① : S = a(ab)^* ab = a(ab)^+$$

$$A \rightarrow aA \mid aB \mid a \mid b \Rightarrow A = aA + aB + a + b = aA + ab^+ + a + b$$

$$B \rightarrow bB \mid b \Rightarrow B = bB + b = b^+ = a^*(ab^+ + a + b) = a^*(ab^* + b)$$

