Lecture 6 - Sep 23

Math Review

Constructing All Relations
Domain, Range, Inverse
Image, Restrictions, Subtractions

Announcements/Reminders

- Today's class: notes template posted
- Event-B Summary Document
- Priorities:
 - + Lab1 → Review
 - +Lab2 → Due: This Tuesday (Sep 23)
- Released:
 - + ProgTest guide
 - + 2 Practice Tests
 - + Lab1 solution

Cardinality of Power Set: Interpreting Formula

- Calculate by considering subsets of various cardinalities.
- Calculate by considering whether a member should be included.

Want to know:
$$P(S)$$
 = $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ | $\frac{1}{$

$$|TP(s)|$$

$$|S=\{a,b,c\}\}$$

$$|S=\{$$

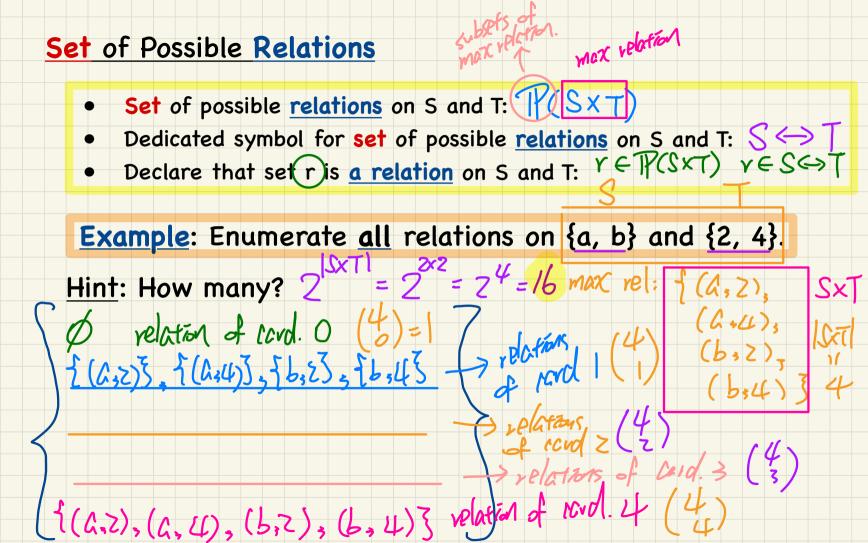
Relation: Let of ordered pairs selation on S and S

- Relation: Let of ordered pairs

- T e.g. Id e.g. a relation on $\{1, 2, 3, 3\}$ and $\{a, b, 3\}$.

Is (1, a) a relation on S and T?

No! "(1, a) R not a set. . Is {(1,a)} a relation on S and T? YES . Is { (0,0)} a relation? No. order 75 word! $R_1 = \{(1, \alpha), (3, b)\}$ $R_1 = R_2$ What is the min relation on S and T? P $R_2 = \{(3, b), (1, \alpha)\}$ $R_1 = R_2$ What is the max relation on S and T? $S \times T$



* { r | r ∈ Tep. ←> Tes x | r | =2} Veparture = 1 toronto, montreal, vanconer3 Pestination = { beizing, seoul, penang?

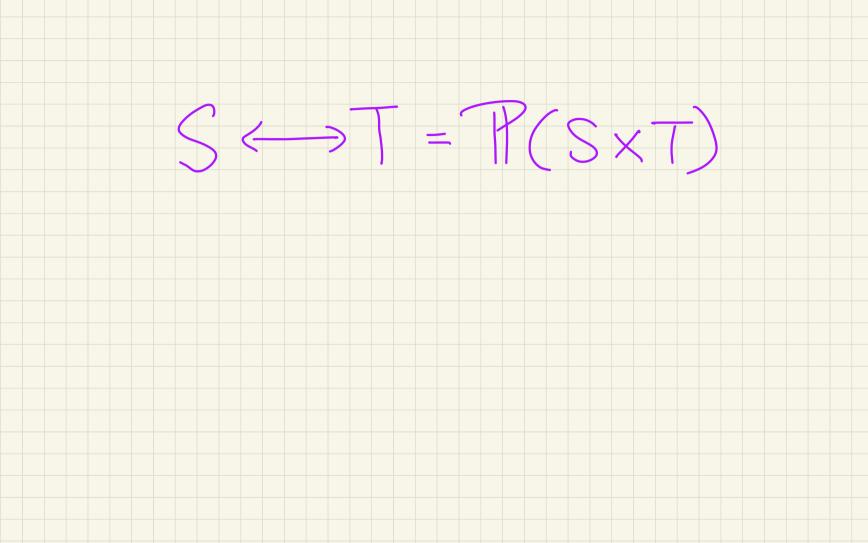
Airline & Reparture (> Testination R(Nep. (Nep.)

A single relation

A single relation

The color of the person of the penang?

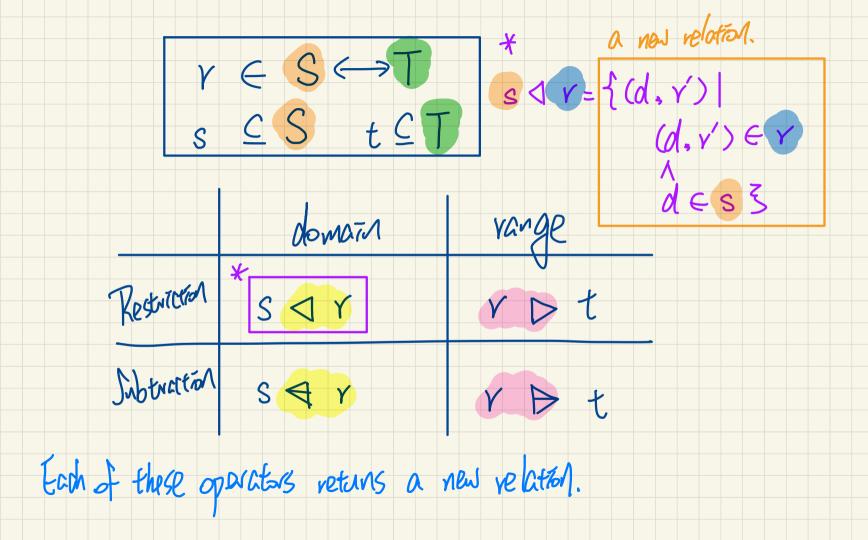
The relation to the p



Relational Operations: Domain, Range, Inverse

$$r = \{(a/1), (b/2), (c/3), (a/4), (b/5), (c/6), (d/1), (e/2), (f/3)\}$$
 $dom(v) = \{a+b+c, d+e+f\}$
 $dom(v) \subseteq Alphabet$
 $r = \{(a,1), (b,2), (c,3), (a,4), (b,6), (c,6), (d,1), (e,2), (f,3)\}$
 $van(v) = \{1,2,3,4,5,6\}$
 $van(v) \subseteq Z$
 $r = \{(a,1), (b,2), (c,3), (a,4), (b,5), (c,6), (d,1), (e,2), (f,3)\}$
 $van(v) = \{1,2,3,4,5,6\}$
 $van(v) \subseteq Z$
 $van($

Relational Operations: Image $r[\{a,h\}] = r[\{a\}] \cup r[\{h\}]$ $r = \{(a,1), (b,2), (c,3), (a,4), (b,5), (c,6), (d,1), (e,2), (f,3)\}$ $7 r \left[\frac{1}{16.63}\right] = \frac{1}{1} r' \left(\frac{0}{1}, r'\right) \in r \land d \in \left\{\frac{1}{16.63}\right\} = \frac{1}{1}, 2, 4, 53$ $S \subseteq Alphalet$ $S \subseteq don(r) \times not nerposony.$ $r \left[\frac{1}{143}\right] = 0$ no value $S \subseteq don(r) \times not nerposony.$ $r \left[\frac{1}{143}\right] = 0$ no no pred $S \subseteq don(r) \times not nerposony.$ Exercises • Image of {a, b} on r? ⊈ { • Image of {1, 2} on r? γ [{1,23] m/e/men! Image of {1, 2} on the inverse of r? [{1,23] = {a,b,d,e} • Calculate r's range via an image. γ [amiv] = γων(γ) • Calculate r's domain via an image. $\sqrt{\gamma_{EM(Y)}} = dom(Y)$



S= {a, b} Relational Operations: Restrictions vs. Subtractions

$$r = \{ (a, 1), (b, 2), (c, 3), (a, 4), (b, 5), (c, 6), (d, 1), (e, 2), (f, 3) \}$$

$$r = \{(a, 1), (b, 2), (c, 3), (a, 4), (b, 5), (c, 6), (d, 1), (e, 2), (f, 3)\}$$

$$r = \{(a, 1), (b, 2), (c, 3), (a, 4), (b, 5), (c, 6), (d, 1), (e, 2), (f, 3)\}$$

$$r = \{(a, 1), (b, 2), (c, 3), (a, 4), (b, 5), (c, 6), (d, 1), (e, 2), (f, 3)\}$$

$$Y \Rightarrow \{1,2\} = \{(C,3), (a,4), (b,5), (C,b), (f,3)\}$$

Relational Operations: Overriding

$$r = \{(a, 1), (b, 2), (c, 3), (a, 4), (b, 5), (c, 6), (d, 1), (e, 2), (f, 3)\}$$

Example: Calculate r overridden with {(a, 3), (c, 4)}

Hint: Decompose results to those in t's domain and those not in t's domain.