

- ① Let  $A = \{1, 2, 3\}$ ,  $B = \{4, 5, 6\}$ , and  $C = \{7, 8, 9\}$ .  
 Also let  $R = \{(1, 4), (1, 6), (3, 5)\}$  be a relation from  $A$  to  $B$ , and  
 $S = \{(4, 9), (5, 7), (5, 8)\}$  a relation from  $B$  to  $C$ .  
 Find:

(a) Dom  $R$ 

$$(2 \text{ pts}) \quad \text{Dom } R = \{1, 3\}$$

(b) Rng  $R$ 

$$(2 \text{ pts}) \quad \text{Rng } R = \{4, 5, 6\}$$

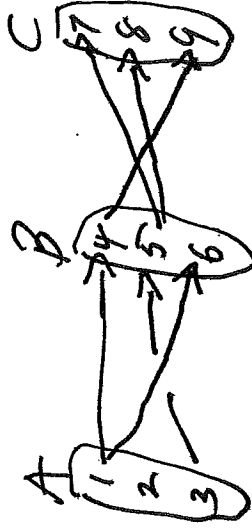
(c)  $R^{-1}$ 

$$(2 \text{ pts}) \quad R^{-1} = \{(4, 1), (6, 1), (5, 3)\}$$

(d)  $S \circ R$ 

(3 pts)

$$S \circ R = \{(1, 9), (3, 7), (3, 8)\}$$



- ② Define a relation  $R$  on the set of all people as follows:  
 $xRy$  iff  $x$  is  $y$ 's daughter. Describe the elements of

$R \circ R$  in terms of family relationships. I.e.,

$(x, z) \in R \circ R$  iff  $x$  and  $z$  have what relationship?

(3 pts)

$$(x, z) \in R \circ R \text{ iff } \exists y \text{ such that } (x, y) \in R \text{ and } (y, z) \in R$$

iff  $\exists y$  such that  $x$  is  $y$ 's daughter and  
 $y$  is  $z$ 's daughter

iff  $z$  is  $x$ 's grandparent on her  
 mother's side.