

$$1) \pi_{sid, sname, bookno, title} ((s \times b) \bowtie t)$$

$$\begin{aligned} & (s.name = 'eric' \vee s.name = 'anna') \wedge \leftarrow C_1 \\ & (s.sid = t.sid) \wedge \leftarrow C_2 \\ & (b.price > 20) \wedge \leftarrow C_3 \\ & (t.bookno = b.bookno) \leftarrow C_4 \end{aligned}$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\sigma_c ((s \times b) \times t)) = (\sigma_c (s \times b \times t)) \quad R25.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\sigma_{c_1} (\sigma_{c_2} (\sigma_{c_4} (\sigma_{c_3} ((s \times b \times t)))))) \quad R18.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\sigma_{c_1} (\sigma_{c_2} (\sigma_{c_3} (s \times (\sigma_{c_4} (b) \times t)))) \quad R18.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\sigma_{c_1} (\sigma_{c_2} (s \times (\sigma_{c_3} (b)) \bowtie t))) \quad R25.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\sigma_{c_2} (\sigma_{c_1} (s) \times (\sigma_{c_3} (b) \bowtie t))) \quad R18.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} ((\sigma_{c_1} (s)) \bowtie (\sigma_{c_3} (b) \bowtie t)) \quad R25.$$

$$\Rightarrow \pi_{sid, sname, bookno, title} (\pi_{sid, sname} (\sigma_{s.name=eric} (s)) \bowtie (\pi_{sid, bookno, title} (\sigma_{price>20} (b) \bowtie t))) \quad R32.$$

$$\Rightarrow \pi_{sid, bookno, title} (\pi_{bookno, title} (\sigma_{price>20} (b)) \bowtie (\pi_{sid, bookno} (t))) \quad R32.$$

$$\Rightarrow \pi_{sid, bookno, title} (\pi_{bookno, title} (\sigma_{price>20} (b)) \bowtie t) \quad R30.$$

$$\Rightarrow (\pi_{bookno, title} (\sigma_{price>20} (b)) \bowtie t) \quad R30.$$

\therefore when it gathers

$$\Rightarrow \pi_{sid, sname, bookno, title} (\pi_{sid, sname} (\sigma_{s.name=eric} (s)) \bowtie (\pi_{bookno, title} (\sigma_{price>20} (b)) \bowtie t))$$

$s.name = anna$

$$2) \pi_{sid} ((s \times b) \bowtie t)$$

$$\begin{aligned} & (s.name = 'eric' \vee s.name = 'anna') \wedge \\ & (s.sid = t.sid) \wedge \\ & (b.price > 20) \wedge \\ & (t.bookno = b.bookno) \end{aligned}$$

$$\Rightarrow \pi_{sid} (\sigma_c (s \times b \times t)) \quad R25.$$

$$\Rightarrow \pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (\sigma_{s.sid=t.sid} (\sigma_{b.bookno=b.bookno} (s \times (\sigma_{price>20} (b) \times t)))) \quad R18.$$

$$\Rightarrow \pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (\sigma_{s.sid=t.sid} (s \times (\sigma_{price>20} (b) \bowtie t)))) \quad R25.$$

$$\Rightarrow \pi_{sid} (\sigma_{s.sid=t.sid} (\sigma_{s.name=eric \vee s.name=anna} (s) \times (\sigma_{price>20} (b) \bowtie t))) \quad R18.$$

$$\Rightarrow \pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (s) \bowtie_{s.sid=t.sid} (\sigma_{price>20} (b) \bowtie t)) \quad R25.$$

$$\Rightarrow \pi_{sid} (\pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (s)) \bowtie_{s.sid=t.sid} (\pi_{sid} (\sigma_{price>20} (b) \bowtie t))) \quad R32.$$

$$\Rightarrow \pi_{sid} (\pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (s)) \wedge \pi_{sid} ((\sigma_{price>20} (b) \bowtie t))) \quad R31.$$

$$\Rightarrow \pi_{sid} (\sigma_{s.name=eric \vee s.name=anna} (s)) \wedge \pi_{sid} (\sigma_{price>20} (b) \bowtie t)$$

Piazza states that "it would be fine to just state that
* the natural join picks the values that are common in each relation and merge them, thus producing the intersection.

$$8. \pi_{sid, sname} (\pi_{sid, sname, bookno} (S \times \sigma_{bookno=2007} (b)) \cap \pi_{sid, sname, bookno} ((S \times b) \bowtie_{s.sid=t.sid \wedge t.bookno=b.bookno \wedge Price < 25} t))$$

$$\Rightarrow \pi_{sid, sname} (\sigma_{bookno=2007} (\pi_{sid, sname, bookno} (S \times b)) \cap \pi_{sid, sname, bookno} ((S \times b) \bowtie_{s.sid=t.sid \wedge t.bookno=b.bookno \wedge Price < 25} t)) \quad R_{29}$$

$$\Rightarrow \pi_{sid, sname} (\pi_{sid, sname, bookno} (S \times b)) \cap \pi_{sid, sname, bookno} (\sigma_{bookno=2007} (S \times b) \bowtie_{s.sid=t.sid \wedge t.bookno=b.bookno \wedge Price < 25} t)) \quad R_{23}$$

$$\Rightarrow \pi_{sid, sname} (\pi_{sid, sname, bookno} (S \times b)) \cap \pi_{sid, sname, bookno} (\sigma_{bookno=2007} (\sigma_{s.sid=t.sid} (\sigma_{t.bookno=b.bookno} (S \times \sigma_{bookno=2007} (t)) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))) \quad R_{25}$$

$$\Rightarrow \pi_{sid, sname, bookno} (\sigma_{s.sid=t.sid} (\sigma_{t.bookno=b.bookno} (S \times \sigma_{bookno=2007} (t)) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))) \quad R_{25}$$

$$\Rightarrow \pi_{sid, sname, bookno} (S \bowtie_{Price < 25} (\sigma_{bookno=2007} (t) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))$$

$$\Rightarrow \pi_{sid, sname} (\pi_{sid, sname, bookno} (S \times b)) \cap \pi_{sid, sname, bookno} (S \bowtie_{Price < 25} (\sigma_{bookno=2007} (t) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))$$

$$\Rightarrow \pi_{sid, sname} (S \bowtie_{Price < 25} (\sigma_{bookno=2007} (t) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))$$

When it gathers $\Rightarrow \pi_{sid, sname} (\pi_{sid, sname, bookno} (S \times b)) \cap$

$R_{25} = S$
if BER $\Rightarrow \pi_{sid, sname} (S \bowtie_{Price < 25} (\sigma_{bookno=2007} (t) \times \sigma_{bookno=2007 \wedge Price < 25} (b)))$