

3 (b) (i)

$$\forall x Rxx$$

$$\forall x \forall y (Rxy \equiv Ryx)$$

$$\forall x \forall y \forall z ((Rxy \wedge Ryz) \supset Rxz)$$

$$\neg \forall x \forall y \forall z ((Rxy \wedge Rxz) \supset Ryz)$$

$$\exists x \neg \forall y \forall z ( \text{_____} )$$

$$\neg \forall y \forall z ((Ray \wedge Ryz) \supset Ryz)$$

$$\exists y \neg \forall z ( \text{_____} )$$

$$\neg \forall z ((Rab \wedge Ryz) \supset Rbz)$$

$$\exists z \neg ( \text{_____} )$$

$$\neg ((Rab \wedge Rac) \supset Rbc)$$

$$Rab \wedge Rac$$

$$\neg Rbc$$

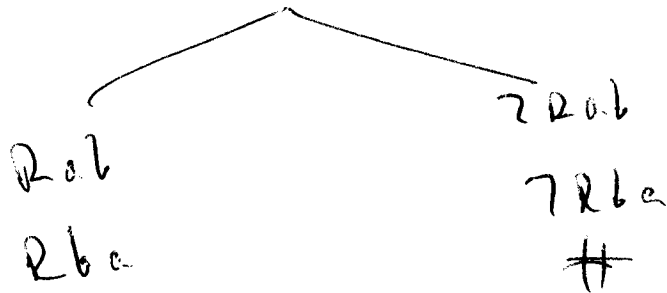
$$Rab$$

$$Rac$$

(2)

$$\forall y (R_{ay} \equiv R_{ya})$$

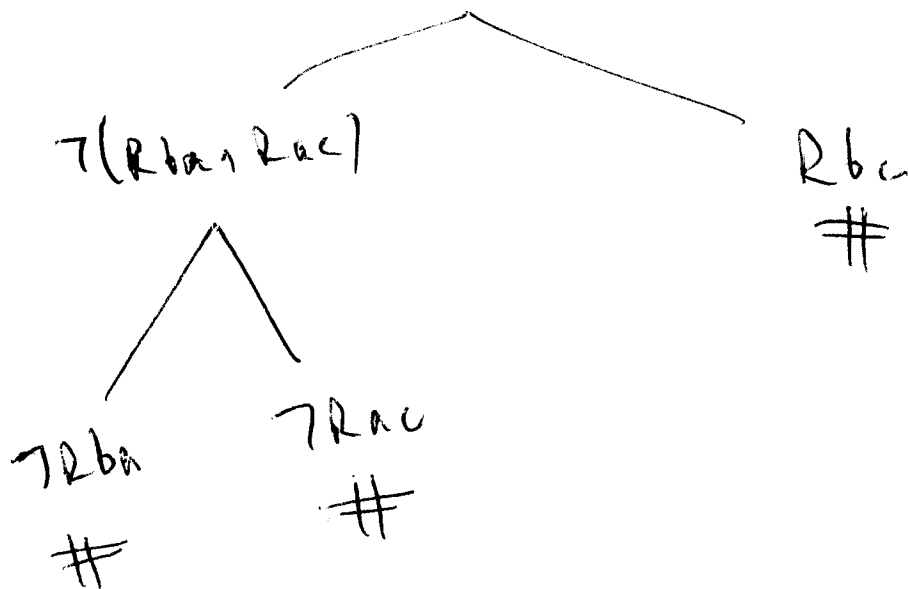
$$R_{ab} \equiv R_{ba}$$



$$\forall y \forall z ((R_{by} \wedge R_{yz}) \supset R_{bz})$$

$$\forall z ((R_{ba} \wedge R_{az}) \supset R_{bz})$$

$$(R_{ba} \wedge R_{ac}) \supset R_{bc}$$



(3)

3 (b) (i)

$$\forall x \forall y (Rxy \equiv Ryx)$$

$$\forall x \forall y \forall z ((Rxy \wedge Ryz) \supset Ryz)$$

$$\forall x \forall y (Rxy \equiv R'yx)$$

$$\neg (\forall x \forall y (R'xy \equiv R'yx) \wedge \forall x \forall y \forall z ((R'xy \wedge R'yz) \supset R'yz))$$

$$\neg \forall x \forall y (R'xy \equiv R'yx)$$

$$\exists x \neg \forall y ( \text{---} ) \checkmark$$

$$\neg \forall y (R'ay \equiv R'ya)$$

$$\exists y \neg ( \text{---} ) \checkmark$$

$$\neg (R'ab \equiv R'ba) \checkmark$$

$$\forall y (Ray \equiv Rya)$$

$$Rab \equiv Rba \checkmark$$

$$\forall y (R'ay \equiv R'ya)$$

$$R'ab \equiv R'ba \checkmark$$

①

$$\neg \forall x \forall y \forall z ((R'xy \wedge R'yz) \supset R'yz)$$

$$\exists x \neg \forall y \forall z ( \text{---} ) \checkmark$$

$$\neg \forall y \forall z ((R'ay \wedge R'yz) \supset R'yz)$$

$$\exists y \neg \forall z ( \text{---} ) \checkmark$$

$$\neg \forall z ((R'ab \wedge R'az) \supset R'bz)$$

$$\exists z \neg ( \text{---} ) \checkmark$$

$$\neg ((R'ab \wedge R'ac) \supset R'bc) \checkmark$$

$$R'ab \wedge R'ac$$

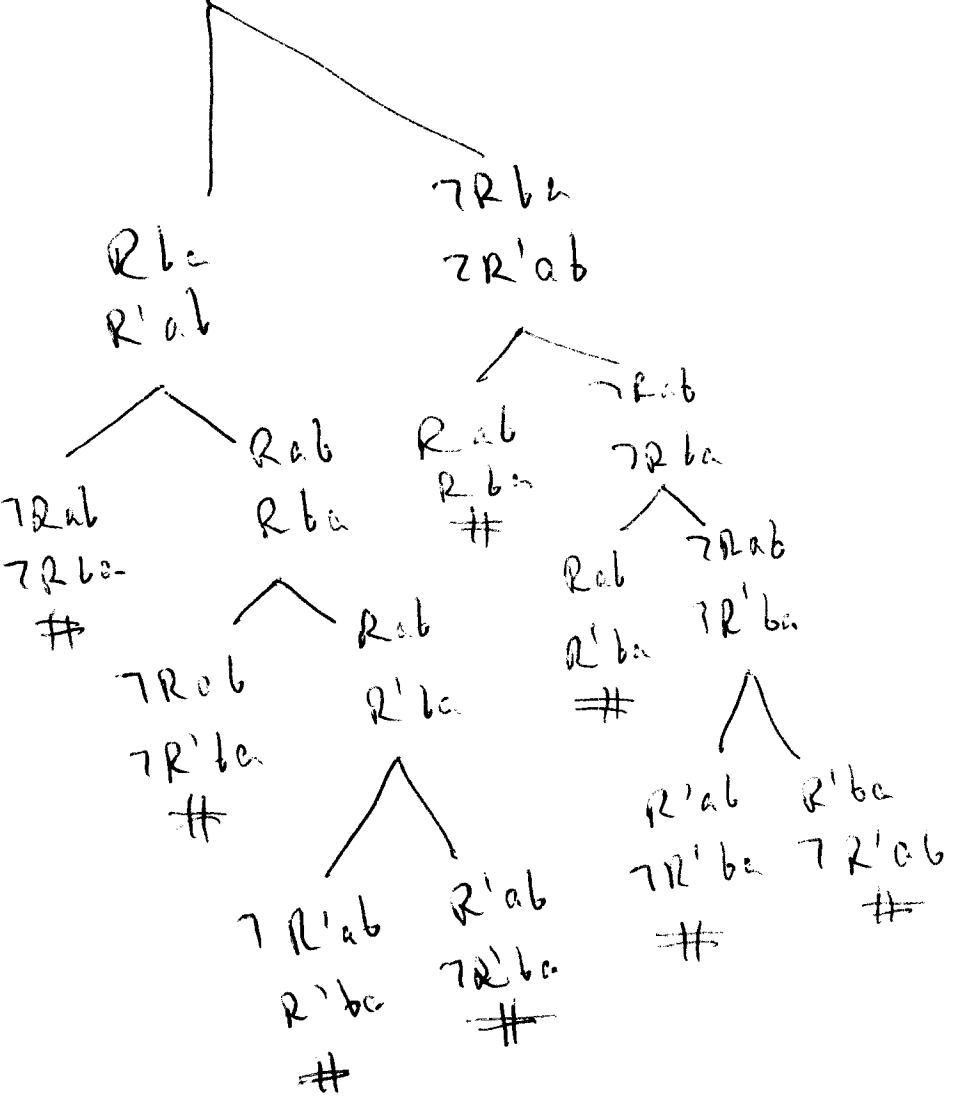
$$\neg R'bc$$

| ②

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$$\forall y (Rby \equiv R'yb)$$

$$Rba \equiv R'ab \quad \checkmark$$



$$\forall y \forall z ((Ray \wedge Raz) \supset Ryz)$$

$$\forall z ((Rab \wedge Rac) \supset Rbz)$$

$$(Rab \wedge Rac) \supset Rbc$$

$$\forall y (Rby \equiv R'yb)$$

$$Rbc \equiv R'cb$$

1  
2

2

$\forall y (Rby \equiv Ryb)$

$Rbc \equiv Rcb$

$\forall y (Rcy \equiv R'yc)$

$Rcb \equiv R'bc$

$\forall y (Ray \equiv Rya)$

$Rab \equiv Rba$

$\forall y (Rcy \equiv R'yc)$

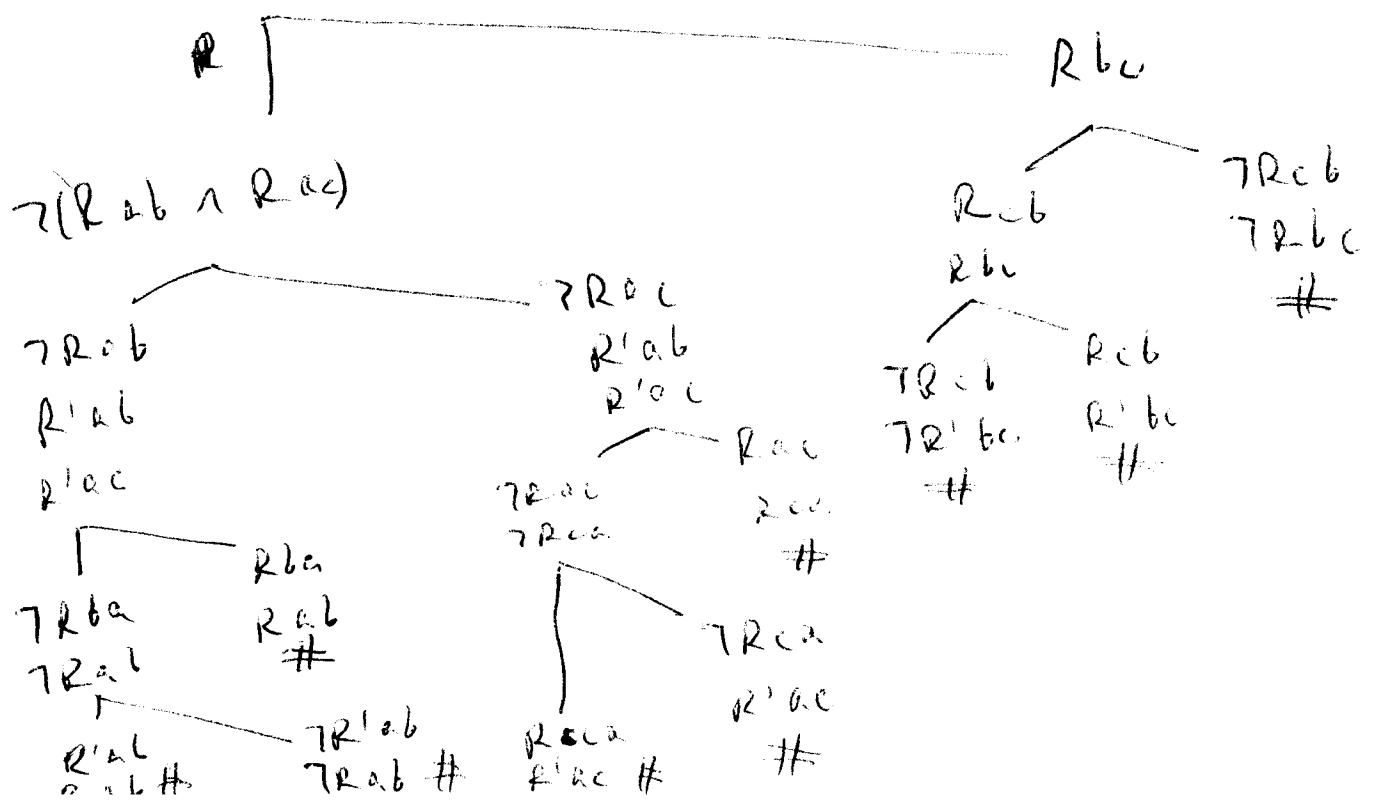
$Rac \equiv Rca$

$\forall y (Rcy \equiv R'yc)$

$Rca \equiv R'ac$

$\forall y (Rby \equiv R'yb)$

$Rba \equiv R'ab$



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3 (i) (iii)

$$\forall x R x x$$

$$\forall x \forall y (R x y \equiv R' y x)$$

$$\neg \forall x R' x x$$

$$\exists x \neg R' x x \quad \checkmark$$

$$\neg R' a a$$

$$\forall y (R a y \equiv R' y a)$$

$$R a a \equiv R' a a \quad \checkmark$$

$$R a a$$

$$\neg R a a$$

$$\neg R' a a$$

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$$R a a$$

$$R' a a$$

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