① (a) $G(a,b) \overset{def}{=} \exists x\,(P(a,x) \wedge P(x,b))$

(b) $S(a,b) \overset{def}{=} \exists x\,(P(x,a) \wedge P(x,b))$ where $a \neq b$

(c) $A(a,b) \overset{def}{=} \exists x\,(S(a,x) \wedge P(x,b))$

(d) $C(a,b) \overset{def}{=} \exists x\,(A(x,a) \wedge P(x,b))$

(e) $R(a,b) \overset{def}{=} \exists x\,(C(x,a) \wedge P(x,b))$

(f) $I(a,b) \overset{def}{=} G(a,b) \vee P(a,b) \vee G(b,a) \vee P(b,a) \vee S(a,b) \vee A(a,b) \vee A(b,a)$

② $\neg\exists x\,(x \in A)$: existential quantifier

$\forall x\,(\neg(x \in A))$: universal quantifier