Solutions to Workbook Exercises

Unit 20:

Logic of Relations

Ex. Singular Propositions I.

Symbolize the following statements in terms of the following symbolization key:

U.D.: people	*a*: Annie	*Txy*: *x* is taller than *y*
	b: Betty	*Sxy*: *x* is shorter than *y*
	c: Charlie	
	d: Debbie	

(a)	Annie is shorter than Betty.	Sab
(b)	Betty is shorter than Charlie.	Sbc
(c)	Debbie is taller than Charlie.	Tdc
(d)	Charlie is shorter than Debbie.	Scd
(e)	Betty is shorter than Charlie, but Debbie is not shorter than Charlie.	$Sbc \wedge {\sim}Sdc$
(f)	Annie, Betty and Charlie are shorter than Debbie.	$(Sad \wedge Sbd) \wedge Scd$
(g)	If Annie is shorter than Betty and Betty is shorter than Debbie, then Annie is shorter than Debbie.	$(Sab \wedge Sbd) \rightarrow Sad$
(h)	Either Charlie is shorter than Debbie or Debbie is shorter than Charlie.	$Scd \vee Sdc$
(i)	Charlie is not taller than Debbie, nor is he shorter than Betty.	${\sim}Tcd \wedge {\sim}Scb$

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Ex. Symbolizations.I.

Symbolize the following propositions:

U.D.: people	*b*: Bill Clinton	*Wxy*: *x* is wiser than *y*
	g: George W. Bush	*Pxy*: *x* is more popular than *y*
	h: Hillary Clinton	*Dxy*: *x* deceives *y*

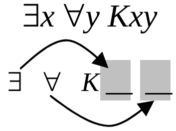
(a)	Bill Clinton is more popular than George W. Bush.	Pbg
(b)	Hillary Clinton is the most popular person.	$\forall x\ Phx$
(c)	Everybody is more popular than George W. Bush.	$\forall x\ Pxg$
(d)	There is a person who is more popular than anybody.	$\exists x\ \forall y\ Pxy$
(e)	Someone is wiser than somebody.	$\exists x\ \exists y\ Wxy$
(f)	Everybody is wiser than someone.	$\forall x\ \exists y\ Wxy$
(g)	There is a person who is wiser than anybody.	$\exists x\ \forall y\ Wxy$
(h)	Somebody deceives someone.	$\exists x\ \exists y\ Dxy$
(i)	Somebody is deceived by someone.	$\exists x\ \exists y\ Dyx$
(j)	Everybody is deceived by someone.	$\forall x\ \exists y\ Dyx$
(k)	There is a person who is deceived by everybody.	$\exists x\ \forall y\ Dyx$
(l)	There is a person who deceives everybody.	$\exists x\ \forall y\ Dxy$
(m)	Everybody deceives someone.	$\forall x\ \exists y\ Dxy$

Ex. Variables-are-Not-Names.I.

Complete the alternative representations of the following statements:

(a)

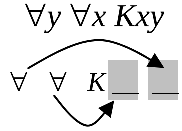
$\exists x\ \forall y\ Kxy$



$\exists y\ \forall x$	Kyx
$\exists z\ \forall x$	Kzx
$\exists x\ \forall z$	Kxz
$\exists z\ \forall y$	Kzy
$\exists y\ \forall z$	Kyz

(b)

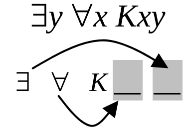
$\forall y\ \forall x\ Kxy$



$\forall x\ \forall y$	Kyx
$\forall z\ \forall x$	Kxz
$\forall x\ \forall z$	Kzx
$\forall z\ \forall y$	Kyz
$\forall y\ \forall z$	Kzy

(c)

$\exists y\ \forall x\ Kxy$



$\exists x\ \forall y$	Kyx
$\exists z\ \forall x$	Kxz
$\exists x\ \forall z$	Kzx
$\exists y\ \forall z$	Kzy
$\exists z\ \forall y$	Kyz

Ex. Symbolizations.II.

U.D.: people *Wx*: *x* is a woman *Mx*: *x* is a man *Lxy*: *x* loves *y*

(a)	All women love somebody.	$\forall x\ (Wx \rightarrow \exists y\ Lxy)$
(b)	There is a man who loves everyone.	$\exists x\ (Mx \bullet \forall y\ Lxy)$
(c)	There is a man who loves every woman.	$\exists x\ (Mx \bullet \forall y\ (Wy \rightarrow Lxy))$
(d)	All women love some man.	$\forall x\ (Wx \rightarrow \exists y\ (My \bullet Lxy))$
(e)	All men love some woman.	$\forall x\ (Mx \rightarrow \exists y\ (Wy \bullet Lxy))$
(f)	Some men are loved by everyone.	$\exists x\ (Mx \bullet \forall y\ Lyx)$
(g)	Some women are loved by some men.	$\exists x\ (Wx \bullet \exists y\ (My \bullet Lyx))$
(h)	All men love themselves.	$\forall x\ (Mx \rightarrow Lxx)$
(i)	Every man is loved by some woman.	$\forall x\ (Mx \rightarrow \exists y\ (Wy \bullet Lyx))$
(j)	There is a woman who loves every man.	$\exists x\ (Wx \bullet \forall y\ (My \rightarrow Lxy))$
(k)	There is no woman who loves every man.	$\sim \exists x\ (Wx \bullet \forall y\ (My \rightarrow Lxy))$
(l)	Not every man loves some woman.	$\sim \forall x\ (Mx \rightarrow \exists y\ (Wy \rightarrow Lxy))$
(m)	Only men love themselves.	$\forall x\ (Lxx \rightarrow Mx)$
(n)	Not all women love themselves	$\sim \forall x\ (Wx \rightarrow Lxx)$
(o)	No man is loved by all women.	$\sim \exists x\ (Mx \bullet \forall y\ (Wy \rightarrow Lyx))$
(p)	Not only men love themselves.	$\sim \forall x\ (Lxx \rightarrow Mx)$

Ex. Symbolizations.III.

U.D.: people	*Mx: x* is a man	*Wx: x* is a woman	*Dxy*: *x* deceive *y*
	Px: *x* is a politician	*Rx*: *x* is rich	*Sxy: x* steals from *y*

(a)	All politicians deceive someone.	$\forall x\ (Px \rightarrow \exists y\ Dxy)$
(b)	Someone is deceived by all politicians.	$\exists x\ \forall y\ (Py \rightarrow Dyx)$
(c)	No woman politician is rich.	$\sim\exists x\ ((Wx \bullet Px) \bullet Rx)$ $\forall x\ ((Wx \bullet Px) \rightarrow \sim Rx)$
(d)	All man politicians are rich.	$\forall x\ ((Mx \bullet Px) \rightarrow Rx)$
(e)	Every rich politician steals from someone.	$\forall x\ ((Rx \bullet Px) \rightarrow \exists y\ Sxy)$
(f)	Every rich politician steals from someone who is not rich.	$\forall x\ ((Rx \bullet Px) \rightarrow \exists y\ (\sim Ry \bullet Sxy))$
(g)	Every woman politician is deceived by some man politician.	$\forall x\ ((Wx \bullet Px) \rightarrow \exists y\ ((My \bullet Py) \bullet Dyx))$
(h)	Only men are rich.	$\forall x\ (Rx \rightarrow Mx)$
(i)	Only those who steal from someone are rich.	$\forall x\ (Rx \rightarrow \exists y\ Sxy)$
(j)	Every politician who deceives someone is deceived by someone.	$\forall x\ ((Px \bullet \exists y\ Dxy) \rightarrow \exists z\ Dzx)$
(k)	There is a person who steals from someone and deceives everyone.	$\exists x\ (\exists y\ Sxy \bullet \forall z\ Dxz\ )$
(l)	Not everybody who deceives someone is deceived by everybody.	$\sim \forall x\ (\exists y\ Dxy \rightarrow \forall z\ Dzx)$ $\exists x\ (\exists y\ Dxy \bullet \sim\forall z\ Dzx)$
(m)	Only men deceive themselves.	$\forall x\ (Dxx \rightarrow Mx)$