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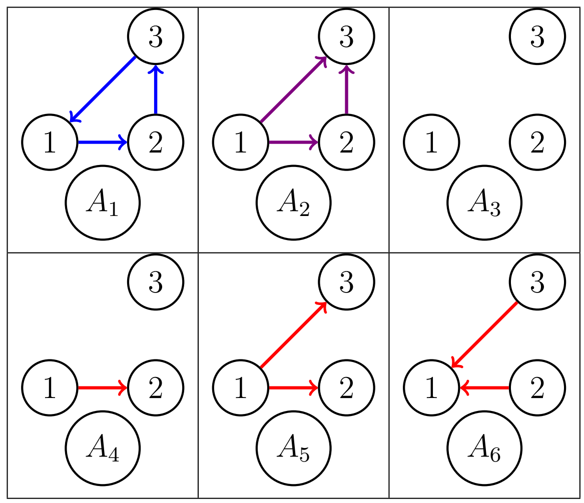
LGIC 010 & PHIL 005 Practice Final Examination Spring Term, 2016

1. Let S be the conjunction of the following schemata.

- $(\forall x)(\forall y)(Lxy \supset \neg Lyx)$
- $(\forall x)(\forall y)(x \neq y \supset (Lxy \vee Lyx)) \vee (\forall x)(\forall y)(\forall z)(Lxy \supset (Lyz \supset Lxz))$

(a) (15 points) Construct a maximal length succinct list l of structures such that each structure listed on l is a member of $\mathsf{mod}(S, 3)$.



(b) (15 points) For each structure A on your list l and each $O \in \mathsf{Orbs}(A)$ write down a schema $S(x)$ such that $S[A] = O$.

A	$O \in \mathsf{Orbs}(A)$	$S[A] = O$
A_1	$\{1, 2, 3\}$	$x = x$
A_2	$\{1\}$	$(\forall y)\neg Lyx$
	$\{2\}$	$(\exists y)Lyx \wedge (\exists y)Lxy$
	$\{3\}$	$(\forall y)\neg Lxy$
A_3	$\{1, 2, 3\}$	$x = x$
A_4	$\{1\}$	$(\exists y)Lxy$
	$\{2\}$	$(\exists y)Lyx$
	$\{3\}$	$\neg(\exists y)Lxy \wedge \neg(\exists y)Lyx$
A_5	$\{1\}$	$(\exists y)Lxy$
	$\{2, 3\}$	$\neg(\exists y)Lxy$
A_6	$\{1\}$	$(\exists y)Lyx$
	$\{2, 3\}$	$\neg(\exists y)Lyx$

2. Let A be a structure interpreting a single triadic predicate letter P and a single dyadic predicate letter L with $U^A = \mathbb{Z}$, $P^A = \{\langle i, j, k\rangle \mid i + j = k\}$, the sum relation on $\mathbb{Z}$, and $L^A = \{\langle i, j\rangle \mid j = |i|\}$, the absolute-value relation on $\mathbb{Z}$.

   (a) (15 points) Let $X_1 = \{i \in \mathbb{Z} \mid i < 0\} = \{-1, -2, -3, \ldots\}$. Is X_1 definable in A? If it is, write down a schema $S_1(x)$ such that $S_1[A] = X_1$; if not, specify an $h_1 \in \mathsf{Aut}(A)$ such that $h_1[X_1] \neq X_1$.

$$S_1(x) : (\forall y)\neg Lyx$$

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   (b) (15 points) Let $X_2 = \{i \in \mathbb{Z} \mid i > 0 \text{ and there is a } j \in \mathbb{Z} \text{ such that } i = 5j + 3\} = \{3, 8, 13, \ldots\}$. Is X_2 definable in A? If it is, write down a schema $S_2(x)$ such that $S_2[A] = X_2$; if not, specify an $h_2 \in \mathsf{Aut}(A)$ such that $h_2[X_2] \neq X_2$.

   TO BE CONTINUED