Next-Next-Gen Notes

Object-Oriented Maths

JP Guzman

March 15, 2018

${}^{THM-LDMr-1}_{POS-LDis^!}((xOR^!y)OR^!(NOT^!xAND^!NOT^!y)=((xOR^!y)OR^!NOT^!x)AND^!((xOR^!y)OR^!NOT^!y)),$

${}^{THM-LDMr-2}_{\substack{POS-LCom^! \\ THM-LAsc^!}}(((xOR^!y)OR^!NOT^!x)AND^!((xOR^!y)OR^!NOT^!y)=((xOR^!NOT^!x)OR^!y)AND^!((NOT^!yOR^!y)OR^!x)),$

${}^{THM-LDMr-3}_{POS-LCmp^!}(((xOR^!NOT^!x)OR^!y)AND^!((NOT^!yOR^!y)OR^!x)=(T^!OR^!y)AND^!(T^!OR^!x)),$

${}^{THM-LDMr-4}_{THM-LDom^!}((T^!OR^!y)AND^!(T^!OR^!x)=T^!AND^!T^!),$

${}^{THM-LDMr-5}_{THM-LIdm^!}(T^!AND^!T^!=T^!),$

${}^{THM-LDMr-6}_{\substack{THM-LDMr-1 \\ THM-LDMr-2 \\ THM-LDMr-3 \\ THM-LDMr-4 \\ THM-LDMr-5}}((xOR^!y)OR^!(NOT^!xAND^!NOT^!y)=T^!).$

${}^{THM-LDMr-7}_{THM-LDis^!}((xOR^!y)AND^!(NOT^!xAND^!NOT^!y)=(xAND^!NOT^!xAND^!NOT^!y)OR^!(yAND^!NOT^!xAND^!NOT^!y)),$

${}^{THM-LDMr-8}_{\substack{POS-LCom^! \\ THM-LAsc^!}}((xAND^!NOT^!xAND^!NOT^!y)OR^!(yAND^!NOT^!xAND^!NOT^!y)=((xAND^!NOT^!x)AND^!NOT^!y)OR^!((yAND^!N$

${}^{THM-LDMr-9}_{POS-LCmp^!}(((xAND^!NOT^!x)AND^!NOT^!y)OR^!((yAND^!NOT^!y)AND^!NOT^!x)=(F^!AND^!NOT^!y)OR^!(F^!AND^!NOT^!x)),$

${}^{THM-LDMr-10}_{THM-LDom^!}((F^!AND^!NOT^!y)OR^!(F^!AND^!NOT^!x)=F^!OR^!F^!),$

${}^{THM-LDMr-11}_{THM-LIdm^!}(F^!OR^!F^!=F^!),$

${}^{THM-LDMr-12}_{\substack{THM-LDMr-7 \\ THM-LDMr-8 \\ THM-LDMr-9 \\ THM-LDMr-10 \\ THM-LDMr-11}}((xOR^!y)AND^!(NOT^!xAND^!NOT^!y)=F^!).$

${}^{THM-LDMr-13}_{\substack{THM-LDMr-6 \\ THM-LDMr-12 \\ POS-LCmp^!}}(((xOR^!y)OR^!(NOT^!xAND^!NOT^!y)=T^!=(xOR^!y)OR^!NOT^!(xOR^!y)),((xOR^!y)AND^!(NOT^!xAND^!NOT^!y)=$
$F^!=(xOR^!y)AND^!NOT^!(xOR^!y))),$

${}^{THM-LDMr-14}_{\substack{THM-LDMr-13 \\ THM-LUNt^!}}(NOT^!xAND^!NOT^!y=NOT^!(xOR^!y)),$

${}^{THM-LDMr}_{\substack{THM-LDMr-14 \\ THM-Dual^!}}((NOT^!xAND^!NOT^!y=NOT^!(xOR^!y)),(NOT^!xOR^!NOT^!y=NOT^!(xAND^!y))).$

Boolean De Morgan's Laws

${}^{THM-CtrP-1}_{IMPLIESWAT^!}(xIF^!y=(NOT^!x)OR^!y),$

${}^{THM-CtrP-2}_{\substack{POS-LCom^! \\ THM-LInv^!}}((NOT^!x)OR^!y=((NOT^!NOT^!y)OR^!(NOT^!x))),$

${}^{THM-CtrP-3}_{IMPLIESWAT^!}((NOT^!NOT^!y)OR^!(NOT^!x)=(NOT^!y)IF^!(NOT^!x)),$

${}^{THM-CtrP}_{\substack{THM-CtrP-1 \\ THM-CtrP-2 \\ THM-CtrP-3}}(xIF^!y=(NOT^!y)IF^!(NOT^!x)).$

Contrapositive Law

$(T^!IF^!x=x)$

$(F^!IF^!x=T^!)$

$(xIF^!T^!=T^!)$

$(xIF^!F^!=NOT^!x)$

$((xOR^!y)IF^!z)=(xIF^!z)AND^!(yIF^!z)$

$(xIF^!(yAND^!z)=(xIF^!y)AND^!(xIF^!z))$

1 Mathematical Logic

1.1 NaiveMaster

$$ \tag{1}$$

$$\{\} \tag{2}$$

$$\{\} \tag{3}$$

undefined terms

$$set, element, \in, \subseteq, =, /\!\!/, \subset, \cup, \cap, \emptyset \tag{4}$$

$$element[x][] \in set[y][]$$
$$\# \text{ x belongs to y} \tag{5}$$

$$set[x][] \subseteq set[y][]$$
$$\# \text{ x is included in y} \tag{6}$$

$$set[x][] = set[y][] := (set[x][] \subseteq set[y][], set[y][] \subseteq set[x][])$$
$$\# \text{ x is the same set as y} \tag{7}$$

$$set[x][] \subset set[y][]((= x \nsubseteq y)) := set[x][] \subseteq set[y][], set[x][] \neq set[y][]$$
$$\# \text{ x is a proper subset of y} \tag{8}$$

$$set[x][] \cup set[y][]$$
$$\# \text{ all elements in x or y} \tag{9}$$

$$set[x][] \cap set[y][]$$
$$\# \text{ all elements in x and y} \tag{10}$$

$$disjoint[x, y][] := set[x][] \cap set[y][] = \emptyset$$
$$\# \text{ disjoint sets do not intersect} \tag{11}$$

$$\{e_1, e_2, e_3, \cdots, e_n\}$$
$$\# \text{ unordered set containing } e_1, e_2, e_3, \cdots, e_n$$
$$\{e_1, e_2, e_3\} = \{e_3, e_1, e_2\} \tag{12}$$

$$\langle e_1, e_2, e_3, \cdots, e_n \rangle := \text{ordered tuple containing } e_1, e_2, e_3, \cdots, e_n$$
$$\langle e_1, e_2, e_3 \rangle \neq \langle e_2, e_3, e_1 \rangle \tag{13}$$

$$X^k = \{e_1, e_2, e_3, \cdots, e_n\}^k := \text{set of all ordered k-tuples from the elements of } e_1, e_2, e_3, \cdots, e_n$$
$$X^1 = \{e_1, e_2, e_3, \cdots, e_n\}^1 = \{\langle e_1 \rangle, \langle e_2 \rangle, \langle e_3 \rangle, \cdots, \langle e_n \rangle\} = \{e_1, e_2, e_3, \cdots, e_n\} = X \tag{14}$$

$$Y \times Z = \{y_1, y_2, y_3, \cdots, y_i\} \times \{z_1, z_2, z_3, \cdots, z_j\} := \text{Cartesian product}$$
$$:= \bigcup_{a \leq i, b \leq j} (\{\langle y_a, z_b \rangle\}) \tag{15}$$

$$R_Y^k \subseteq Y^k := \text{k-tuple relation R on the set Y takes only tuples that satisfy some relation}$$
$$P_Y \subseteq Y := \text{property P of the set Y} \tag{16}$$

$$\langle y, z \rangle \in binaryRelation(R_X^2) = yR_X^2 z$$
$$domain(Y), range(Z)$$
$$field(R) = Y \cup Z$$
$$\langle a, b \rangle \in inverse(R^{-1}) : \langle b, a \rangle \in R$$
$$reflexive(R_X^2) : xR_X^2 x$$
$$symmetric(R_X^2) : xR_X^2 y = yR_X^2 x$$
$$transitive(R_X^2) : xR_X^2 y, yR_X^2 z : xR_X^2 z \tag{17}$$