

## t51\_circrm1

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Let  $v2\_struct\_0 : \iota \Rightarrow o$  be given. Let  $v11\_struct\_0 : \iota \Rightarrow o$  be given. Let  $v2\_msafree2 : \iota \Rightarrow o$  be given. Let  $l1\_msualg\_1 : \iota \Rightarrow o$  be given. Let  $v1\_relat\_1 : \iota \Rightarrow o$  be given. Let  $v1\_funct\_1 : \iota \Rightarrow o$  be given. Let  $v4\_msualg\_1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $v4\_msafree2 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $l3\_msualg\_1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $r5\_circrm1 : \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $m1\_subset\_1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $k4\_card\_3 : \iota \Rightarrow \iota$  be given. Let  $u3\_msualg\_1 : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Let  $k3\_relat\_1 : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Let  $k2\_funct\_1 : \iota \Rightarrow \iota$  be given. Let  $k4\_relat\_1 : \iota \Rightarrow \iota$  be given. Let  $k9\_xtuple\_0 : \iota \Rightarrow \iota$  be given. Let  $v2\_funct\_1 : \iota \Rightarrow o$  be given. Let  $k1\_relset\_1 : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Let  $u1\_struct\_0 : \iota \Rightarrow \iota$  be given. Let  $k10\_xtuple\_0 : \iota \Rightarrow \iota$  be given. Let  $v4\_relat\_1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $v4\_funct\_1 : \iota \Rightarrow o$  be given. Let  $l1\_struct\_0 : \iota \Rightarrow o$  be given. Let  $l2\_msualg\_1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $v2\_relat\_1 : \iota \Rightarrow o$  be given. Let  $v1\_partfun1 : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $l5\_struct\_0 : \iota \Rightarrow o$  be given. Let  $r4\_circrm1 : \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $r3\_puad2mss1 : \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $u4\_struct\_0 : \iota \Rightarrow \iota$  be given. Let  $r1\_tarski : \iota \Rightarrow \iota \Rightarrow o$  be given. Let  $u2\_msualg\_1 : \iota \Rightarrow \iota$  be given. Let  $k1\_funct\_1 : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Let  $u1\_msualg\_1 : \iota \Rightarrow \iota$  be given. Let  $u4\_msualg\_1 : \iota \Rightarrow \iota \Rightarrow \iota$  be given. Assume the following.

$$\forall X0.(v1\_relat\_1 X0) \Rightarrow (k3\_relat\_1 (k4\_relat\_1 (k9\_xtuple\_0 X0)) X0 = X0) \quad (1)$$

Assume the following.

$$\forall X0.((v1\_relat\_1 X0) \wedge (v1\_funct\_1 X0)) \Rightarrow ((v2\_funct\_1 X0) \Rightarrow (k2\_funct\_1 (k2\_funct\_1 X0) = X0)) \quad (2)$$

Assume the following.

$$\forall X0.((\neg v2\_struct\_0 X0) \wedge ((\neg v11\_struct\_0 X0) \wedge ((v2\_msafree2 X0) \wedge (l1\_msualg\_1 X0)))) \Rightarrow (\forall X1.((v4\_msualg\_1 X1 X0) \wedge ((v4\_msafree2 X1 X0) \wedge (l3\_msualg\_1 X1 X0)))) \Rightarrow (\forall X2.(m1\_subset\_1 X2 (k4\_card\_3 (u3\_msualg\_1 X0 X1))) \Rightarrow (k1\_relset\_1 (u1\_struct\_0 X0) X2 = u1\_struct\_0 X0)) \quad (3)$$

Assume the following.

$$\begin{aligned} \forall X0.((v1\_relat\_1 X0) \wedge (v1\_funct\_1 X0)) \Rightarrow ((v2\_funct\_1 X0) \Rightarrow \\ ((k3\_relat\_1 X0 (k2\_funct\_1 X0) = k4\_relat\_1 (k9\_xtuple\_0 X0)) \wedge \\ (k3\_relat\_1 (k2\_funct\_1 X0) X0 = k4\_relat\_1 (k10\_xtuple\_0 X0)))) \end{aligned} \quad (4)$$

Assume the following.

$$\begin{aligned} \forall X0.(v1\_relat\_1 X0) \Rightarrow (\forall X1.(v1\_relat\_1 X1) \Rightarrow (\forall X2. \\ (v1\_relat\_1 X2) \Rightarrow (k3\_relat\_1 (k3\_relat\_1 X0 X1) X2 = k3\_relat\_1 \\ X0 (k3\_relat\_1 X1 X2)))) \end{aligned} \quad (5)$$

Assume the following.

$$\begin{aligned} \forall X0.\forall X1.((v1\_relat\_1 X1) \wedge (v4\_relat\_1 X1 X0)) \Rightarrow ( \\ k1\_relset\_1 X0 X1 = k9\_xtuple\_0 X1) \end{aligned} \quad (6)$$

Assume the following.

$$\begin{aligned} \forall X0.((v1\_relat\_1 X0) \wedge ((v1\_funct\_1 X0) \wedge (v2\_funct\_1 X0))) \Rightarrow \\ ((v1\_relat\_1 (k2\_funct\_1 X0)) \wedge ((v1\_funct\_1 (k2\_funct\_1 X0)) \wedge \\ (v2\_funct\_1 (k2\_funct\_1 X0)))) \end{aligned} \quad (7)$$

Assume the following.

$$\begin{aligned} \forall X0.((v1\_relat\_1 X0) \wedge (v1\_funct\_1 X0)) \Rightarrow (v4\_funct\_1 (k4\_card\_3 \\ X0)) \end{aligned} \quad (8)$$

Assume the following.

$$\begin{aligned} \forall X0.\forall X1.((l1\_struct\_0 X0) \wedge ((v4\_msualg\_1 X1 X0) \wedge \\ (l2\_msualg\_1 X1 X0))) \Rightarrow ((v1\_relat\_1 (u3\_msualg\_1 X0 X1)) \wedge ((v2\_relat\_1 \\ (u3\_msualg\_1 X0 X1)) \wedge ((v4\_relat\_1 (u3\_msualg\_1 X0 X1) (u1\_struct\_0 \\ X0)) \wedge ((v1\_funct\_1 (u3\_msualg\_1 X0 X1)) \wedge (v1\_partfun1 (u3\_msualg\_1 \\ X0 X1) (u1\_struct\_0 X0)))))) \end{aligned} \quad (9)$$

Assume the following.

$$\begin{aligned} \forall X0.\forall X1.((l1\_struct\_0 X0) \wedge (l2\_msualg\_1 X1 X0)) \Rightarrow \\ ((v1\_relat\_1 (u3\_msualg\_1 X0 X1)) \wedge ((v4\_relat\_1 (u3\_msualg\_1 \\ X0 X1) (u1\_struct\_0 X0)) \wedge ((v1\_funct\_1 (u3\_msualg\_1 X0 X1)) \wedge (v1\_partfun1 \\ (u3\_msualg\_1 X0 X1) (u1\_struct\_0 X0)))))) \end{aligned} \quad (10)$$

Assume the following.

$$\forall X0.(l5\_struct\_0 X0) \Rightarrow (l1\_struct\_0 X0) \quad (11)$$

Assume the following.

$$\begin{aligned} \forall X0.((\neg v2\_struct\_0 X0) \wedge (l1\_msualg\_1 X0)) \Rightarrow (\forall X1. \\ (l3\_msualg\_1 X1 X0) \Rightarrow (l2\_msualg\_1 X1 X0)) \end{aligned} \quad (12)$$

Assume the following.

$$\forall X0.(l1\_msualg\_1 X0) \Rightarrow (l5\_struct\_0 X0) \quad (13)$$

Assume the following.

$$\forall X0.((v1\_relat\_1 X0) \wedge (v1\_funct\_1 X0)) \Rightarrow ((v1\_relat\_1 (k2\_funct\_1 X0)) \wedge (v1\_funct\_1 (k2\_funct\_1 X0))) \quad (14)$$

Assume the following.

$$\begin{aligned} & \forall X0.((\neg v2\_struct\_0 X0) \wedge (l1\_msualg\_1 X0)) \Rightarrow (\forall X1. \\ & ((\neg v2\_struct\_0 X1) \wedge (l1\_msualg\_1 X1)) \Rightarrow (\forall X2.((v1\_relat\_1 \\ & X2) \wedge (v1\_funct\_1 X2)) \Rightarrow (\forall X3.((v1\_relat\_1 X3) \wedge (v1\_funct\_1 \\ & X3)) \Rightarrow (\forall X4.((v4\_msualg\_1 X4 X0) \wedge (l3\_msualg\_1 X4 X0)) \Rightarrow ( \\ & \forall X5.((v4\_msualg\_1 X5 X1) \wedge (l3\_msualg\_1 X5 X1)) \Rightarrow ((r5\_circrm1 \\ & X0 X1 X2 X3 X4 X5) \Leftrightarrow ((r4\_circrm1 X0 X1 X2 X3 X4 X5) \wedge (r4\_circrm1 X1 \\ & X0 (k2\_funct\_1 X2) (k2\_funct\_1 X3) X5 X4))))))))) \quad (15) \end{aligned}$$

Assume the following.

$$\begin{aligned} & \forall X0.(l1\_msualg\_1 X0) \Rightarrow (\forall X1.(l1\_msualg\_1 X1) \Rightarrow (\forall X2. \\ & ((v1\_relat\_1 X2) \wedge (v1\_funct\_1 X2)) \Rightarrow (\forall X3.((v1\_relat\_1 \\ & X3) \wedge (v1\_funct\_1 X3)) \Rightarrow ((r3\_pua2mss1 X0 X1 X2 X3) \Leftrightarrow ((k9\_xtuple\_0 \\ & X2 = u1\_struct\_0 X0) \wedge ((k9\_xtuple\_0 X3 = u4\_struct\_0 X0) \wedge ((r1\_tarski \\ & (k10\_xtuple\_0 X2) (u1\_struct\_0 X1)) \wedge ((r1\_tarski (k10\_xtuple\_0 \\ & X3) (u4\_struct\_0 X1)) \wedge ((k3\_relat\_1 (u2\_msualg\_1 X0) X2 = k3\_relat\_1 \\ & X3 (u2\_msualg\_1 X1)) \wedge (\forall X4.\forall X5.((v1\_relat\_1 X5) \wedge \\ & (v1\_funct\_1 X5)) \Rightarrow (((X4 \in u4\_struct\_0 X0) \wedge (X5 = k1\_funct\_1 (u1\_msualg\_1 \\ & X0) X4)) \Rightarrow (k3\_relat\_1 X5 X2 = k1\_funct\_1 (u1\_msualg\_1 X1) (k1\_funct\_1 \\ & X3 X4))))))))))))) \quad (16) \end{aligned}$$

Assume the following.

$$\begin{aligned} & \forall X0.((\neg v2\_struct\_0 X0) \wedge (l1\_msualg\_1 X0)) \Rightarrow (\forall X1. \\ & ((\neg v2\_struct\_0 X1) \wedge (l1\_msualg\_1 X1)) \Rightarrow (\forall X2.((v1\_relat\_1 \\ & X2) \wedge (v1\_funct\_1 X2)) \Rightarrow (\forall X3.((v1\_relat\_1 X3) \wedge (v1\_funct\_1 \\ & X3)) \Rightarrow (\forall X4.((v4\_msualg\_1 X4 X0) \wedge (l3\_msualg\_1 X4 X0)) \Rightarrow ( \\ & \forall X5.((v4\_msualg\_1 X5 X1) \wedge (l3\_msualg\_1 X5 X1)) \Rightarrow ((r4\_circrm1 \\ & X0 X1 X2 X3 X4 X5) \Leftrightarrow ((v2\_funct\_1 X2) \wedge ((v2\_funct\_1 X3) \wedge ((r3\_pua2mss1 \\ & X0 X1 X2 X3) \wedge ((u3\_msualg\_1 X0 X4 = k3\_relat\_1 X2 (u3\_msualg\_1 X1 X5)) \wedge \\ & (u4\_msualg\_1 X0 X4 = k3\_relat\_1 X3 (u4\_msualg\_1 X1 X5))))))))))))) \quad (17) \end{aligned}$$

Assume the following.

$$\forall X0.(v4\_funct\_1 X0) \Rightarrow (\forall X1.(m1\_subset\_1 X1 X0) \Rightarrow ((v1\_relat\_1 X1) \wedge (v1\_funct\_1 X1))) \quad (18)$$

Assume the following.

$$\begin{aligned} \forall X0.\forall X1.((v1\_relat\_1 X1)\wedge((v2\_relat\_1 X1)\wedge((v4\_relat\_1 \\ X1 X0)\wedge(v1\_funct\_1 X1))))\Rightarrow(\forall X2.(m1\_subset\_1 X2 (k4\_card\_3 \\ X1))\Rightarrow(v4\_relat\_1 X2 X0)) \end{aligned} \quad (19)$$

**Theorem 1**

$$\begin{aligned} \forall X0.((\neg v2\_struct\_0 X0)\wedge((\neg v11\_struct\_0 X0)\wedge((v2\_msafree2 \\ X0)\wedge(l1\_msualg\_1 X0))))\Rightarrow(\forall X1.((\neg v2\_struct\_0 X1)\wedge((\neg \\ v11\_struct\_0 X1)\wedge((v2\_msafree2 X1)\wedge(l1\_msualg\_1 X1))))\Rightarrow(\forall X2. \\ ((v1\_relat\_1 X2)\wedge(v1\_funct\_1 X2))\Rightarrow(\forall X3.((v1\_relat\_1 \\ X3)\wedge(v1\_funct\_1 X3))\Rightarrow(\forall X4.((v4\_msualg\_1 X4 X0)\wedge((v4\_msafree2 \\ X4 X0)\wedge(l3\_msualg\_1 X4 X0))\Rightarrow(\forall X5.((v4\_msualg\_1 X5 X1)\wedge \\ ((v4\_msafree2 X5 X1)\wedge(l3\_msualg\_1 X5 X1))\Rightarrow((r5\_circtrm1 X0 X1 \\ X2 X3 X4 X5)\Rightarrow(\forall X6.(m1\_subset\_1 X6 (k4\_card\_3 (u3\_msualg\_1 \\ X0 X4))\Rightarrow(\forall X7.(m1\_subset\_1 X7 (k4\_card\_3 (u3\_msualg\_1 \\ X1 X5))\Rightarrow((X6 = k3\_relat\_1 X2 X7)\Leftrightarrow(X7 = k3\_relat\_1 (k2\_funct\_1 X2 \\ X6)))))))))))))) \end{aligned}$$