
MODULE *model*

EXTENDS *Integers, Naturals, Sequences, TLC, TLAPS*

CONSTANT *N*

ASSUME $NNAT \triangleq N \in Nat$

CONSTANTS *MEM_LENGTH, MEM_WIDTH*

VARIABLE *MEM*

$MEMORY \triangleq [0 \dots (MEM_LENGTH) \rightarrow [0 \dots (MEM_WIDTH) \rightarrow \{\text{TRUE}, \text{FALSE}\}]]$

$Init \triangleq MEM = [0 \dots (MEM_LENGTH) \mapsto [0 \dots (MEM_WIDTH) \mapsto \text{FALSE}]]$

$TypeInvariant \triangleq MEM \in MEMORY$

$BVN \triangleq [0 \dots N \rightarrow \{\text{TRUE}, \text{FALSE}\}]$

$BV32 \triangleq [0 \dots 31 \rightarrow \{\text{TRUE}, \text{FALSE}\}]$

$BV64 \triangleq [0 \dots 63 \rightarrow \{\text{TRUE}, \text{FALSE}\}]$

$ANDN \triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in 0 \dots N \mapsto f[i] \wedge g[i]]]]$

$AND32 \triangleq [f \in BV32 \mapsto [g \in BV32 \mapsto [i \in 0 \dots 31 \mapsto f[i] \wedge g[i]]]]$

$AND64 \triangleq [f \in BV64 \mapsto [g \in BV64 \mapsto [i \in 0 \dots 63 \mapsto f[i] \wedge g[i]]]]$

$ORN \triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in 0 \dots N \mapsto f[i] \vee g[i]]]]$

$OR32 \triangleq [f \in BV32 \mapsto [g \in BV32 \mapsto [i \in 0 \dots 31 \mapsto f[i] \vee g[i]]]]$

$OR64 \triangleq [f \in BV64 \mapsto [g \in BV64 \mapsto [i \in 0 \dots 63 \mapsto f[i] \vee g[i]]]]$

$EXPANDN \triangleq [b \in \{\text{TRUE}, \text{FALSE}\} \mapsto [i \in 0 \dots N \mapsto b]]$

$EXPAND64 \triangleq [b \in \{\text{TRUE}, \text{FALSE}\} \mapsto [i \in 0 \dots 63 \mapsto b]]$

$XORN \triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in 0 \dots N \mapsto ((f[i] \wedge \neg g[i]) \vee (\neg f[i] \wedge g[i]])]]]$

$XOR64 \triangleq [f \in BV64 \mapsto [g \in BV64 \mapsto [i \in 0 \dots 63 \mapsto ((f[i] \wedge \neg g[i]) \vee (\neg f[i] \wedge g[i]])]]]$

$CMP32 \triangleq [f \in BVN \mapsto [g \in BVN \mapsto$
 $\neg XORN[f][g][0] \wedge \neg XORN[f][g][1] \wedge \neg XORN[f][g][2] \wedge$
 $\neg XORN[f][g][3] \wedge \neg XORN[f][g][4] \wedge \neg XORN[f][g][5] \wedge$
 $\neg XORN[f][g][6] \wedge \neg XORN[f][g][7] \wedge \neg XORN[f][g][8] \wedge$
 $\neg XORN[f][g][9] \wedge \neg XORN[f][g][10] \wedge \neg XORN[f][g][11] \wedge$
 $\neg XORN[f][g][12] \wedge \neg XORN[f][g][13] \wedge \neg XORN[f][g][14] \wedge$
 $\neg XORN[f][g][15] \wedge \neg XORN[f][g][16] \wedge \neg XORN[f][g][17] \wedge$
 $\neg XORN[f][g][18] \wedge \neg XORN[f][g][19] \wedge \neg XORN[f][g][20] \wedge$
 $\neg XORN[f][g][21] \wedge \neg XORN[f][g][22] \wedge \neg XORN[f][g][23] \wedge$

$$\neg XORN[f][g][24] \wedge \neg XORN[f][g][25] \wedge \neg XORN[f][g][26] \wedge \\ \neg XORN[f][g][27] \wedge \neg XORN[f][g][28] \wedge \neg XORN[f][g][29] \wedge \\ \neg XORN[f][g][30] \wedge \neg XORN[f][g][31]]]$$

$$CMP64 \triangleq [f \in BVN \mapsto [g \in BVN \mapsto$$

$$\neg XORN[f][g][0] \wedge \neg XORN[f][g][1] \wedge \neg XORN[f][g][2] \wedge \\ \neg XORN[f][g][3] \wedge \neg XORN[f][g][4] \wedge \neg XORN[f][g][5] \wedge \\ \neg XORN[f][g][6] \wedge \neg XORN[f][g][7] \wedge \neg XORN[f][g][8] \wedge \\ \neg XORN[f][g][9] \wedge \neg XORN[f][g][10] \wedge \neg XORN[f][g][11] \wedge \\ \neg XORN[f][g][12] \wedge \neg XORN[f][g][13] \wedge \neg XORN[f][g][14] \wedge \\ \neg XORN[f][g][15] \wedge \neg XORN[f][g][16] \wedge \neg XORN[f][g][17] \wedge \\ \neg XORN[f][g][18] \wedge \neg XORN[f][g][19] \wedge \neg XORN[f][g][20] \wedge \\ \neg XORN[f][g][21] \wedge \neg XORN[f][g][22] \wedge \neg XORN[f][g][23] \wedge \\ \neg XORN[f][g][24] \wedge \neg XORN[f][g][25] \wedge \neg XORN[f][g][26] \wedge \\ \neg XORN[f][g][27] \wedge \neg XORN[f][g][28] \wedge \neg XORN[f][g][29] \wedge \\ \neg XORN[f][g][30] \wedge \neg XORN[f][g][31] \wedge \\ \neg XORN[f][g][32] \wedge \neg XORN[f][g][33] \wedge \neg XORN[f][g][34] \wedge \\ \neg XORN[f][g][35] \wedge \neg XORN[f][g][36] \wedge \neg XORN[f][g][37] \wedge \\ \neg XORN[f][g][38] \wedge \neg XORN[f][g][39] \wedge \neg XORN[f][g][40] \wedge \\ \neg XORN[f][g][41] \wedge \neg XORN[f][g][42] \wedge \neg XORN[f][g][43] \wedge \\ \neg XORN[f][g][44] \wedge \neg XORN[f][g][45] \wedge \neg XORN[f][g][46] \wedge \\ \neg XORN[f][g][47] \wedge \neg XORN[f][g][48] \wedge \neg XORN[f][g][49] \wedge \\ \neg XORN[f][g][50] \wedge \neg XORN[f][g][51] \wedge \neg XORN[f][g][52] \wedge \\ \neg XORN[f][g][53] \wedge \neg XORN[f][g][54] \wedge \neg XORN[f][g][55] \wedge \\ \neg XORN[f][g][56] \wedge \neg XORN[f][g][57] \wedge \neg XORN[f][g][58] \wedge \\ \neg XORN[f][g][59] \wedge \neg XORN[f][g][60] \wedge \neg XORN[f][g][61] \wedge \\ \neg XORN[f][g][62] \wedge \neg XORN[f][g][63]]]$$

$$CMP_EQ_LT_GT \triangleq [b0 \in \{\text{TRUE}, \text{FALSE}\} \mapsto [b1 \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ [i \in 0 \dots 2 \mapsto \\ ((i = 0) \wedge ((b0 \wedge b1) \vee (\neg b0 \wedge \neg b1)) \wedge eq) \vee \\ ((i = 1) \wedge ((\neg b0 \wedge b1 \wedge eq) \vee lt)) \vee \\ ((i = 2) \wedge ((b0 \wedge \neg b1 \wedge eq) \vee gt))]]]]]]$$

$$CMP_EQ_LT_GT_1 \triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in 0 \dots 63 \mapsto \\ [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ CMP_EQ_LT_GT[f][i][g][i][eq][lt][gt]]]]]]]$$

$$CMP_EQ_LT_GT_2 \triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in \{x \in 0 \dots 62 : x \% 2 = 0\} \mapsto \\ [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ CMP_EQ_LT_GT_1[f][g][i] \\ [CMP_EQ_LT_GT_1[f][g][i+1][eq][lt][gt][0]] \\ [CMP_EQ_LT_GT_1[f][g][i+1][eq][lt][gt][1]]]]]]]]$$

$$[CMP_EQ_LT_GT_1[f][g][i+1][eq][lt][gt][2]] \quad]]]]]]$$

$$\begin{aligned} CMP_EQ_LT_GT_3 &\triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in 0 \dots 61 \mapsto \\ &\quad [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ &\quad \quad CMP_EQ_LT_GT_1[f][g][i] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+1][eq][lt][gt][0]] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+1][eq][lt][gt][1]] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+1][eq][lt][gt][2]] \\ &\quad \quad]]]]]] \end{aligned}$$

$$\begin{aligned} CMP_EQ_LT_GT_4 &\triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in \{x \in 0 \dots 60 : x\%4 = 0\} \mapsto \\ &\quad [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ &\quad \quad CMP_EQ_LT_GT_2[f][g][i] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+2][eq][lt][gt][0]] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+2][eq][lt][gt][1]] \\ &\quad \quad [CMP_EQ_LT_GT_2[f][g][i+2][eq][lt][gt][2]] \quad]]]]]] \end{aligned}$$

$$\begin{aligned} CMP_EQ_LT_GT_8 &\triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in \{0, 8, 16, 24, 32, 40, 48, 56\} \mapsto \\ &\quad [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ &\quad \quad CMP_EQ_LT_GT_4[f][g][i] \\ &\quad \quad [CMP_EQ_LT_GT_4[f][g][i+4][eq][lt][gt][0]] \\ &\quad \quad [CMP_EQ_LT_GT_4[f][g][i+4][eq][lt][gt][1]] \\ &\quad \quad [CMP_EQ_LT_GT_4[f][g][i+4][eq][lt][gt][2]] \quad]]]]]] \end{aligned}$$

$$\begin{aligned} CMP_EQ_LT_GT_16 &\triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in \{0, 16, 32, 48\} \mapsto \\ &\quad [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ &\quad \quad CMP_EQ_LT_GT_8[f][g][i] \\ &\quad \quad [CMP_EQ_LT_GT_8[f][g][i+8][eq][lt][gt][0]] \\ &\quad \quad [CMP_EQ_LT_GT_8[f][g][i+8][eq][lt][gt][1]] \\ &\quad \quad [CMP_EQ_LT_GT_8[f][g][i+8][eq][lt][gt][2]] \quad]]]]]] \end{aligned}$$

$$\begin{aligned} CMP_EQ_LT_GT_32 &\triangleq [f \in BVN \mapsto [g \in BVN \mapsto [i \in \{0, 32\} \mapsto \\ &\quad [eq \in \{\text{TRUE}, \text{FALSE}\} \mapsto [lt \in \{\text{TRUE}, \text{FALSE}\} \mapsto [gt \in \{\text{TRUE}, \text{FALSE}\} \mapsto \\ &\quad \quad CMP_EQ_LT_GT_16[f][g][i] \\ &\quad \quad [CMP_EQ_LT_GT_16[f][g][i+16][eq][lt][gt][0]] \\ &\quad \quad [CMP_EQ_LT_GT_16[f][g][i+16][eq][lt][gt][1]] \\ &\quad \quad [CMP_EQ_LT_GT_16[f][g][i+16][eq][lt][gt][2]] \quad]]]]]] \end{aligned}$$

$$b0 \triangleq [i \in 0 \dots 63 \mapsto \text{FALSE}]$$

$$b1 \triangleq [i \in 0 \dots 63 \mapsto (i = 0)]$$

$$b2 \triangleq [i \in 0 \dots 63 \mapsto (i = 1)]$$

$$b3 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1)]$$

$$b4 \triangleq [i \in 0 \dots 63 \mapsto (i = 2)]$$

$$b5 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2)]$$

$$b6 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2)]$$

$b7 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2)]$
 $b8 \triangleq [i \in 0 \dots 63 \mapsto (i = 3)]$
 $b9 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 3)]$
 $b10 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 3)]$
 $b11 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 3)]$
 $b12 \triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 3)]$
 $b13 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 3)]$
 $b14 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 3)]$
 $b15 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 3)]$
 $b16 \triangleq [i \in 0 \dots 63 \mapsto (i = 4)]$
 $b17 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 4)]$
 $b18 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 4)]$
 $b19 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 4)]$
 $b20 \triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 4)]$
 $b21 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 4)]$
 $b22 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 4)]$
 $b23 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 4)]$
 $b24 \triangleq [i \in 0 \dots 63 \mapsto (i = 3) \vee (i = 4)]$
 $b25 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 3) \vee (i = 4)]$
 $b26 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 3) \vee (i = 4)]$
 $b27 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 3) \vee (i = 4)]$
 $b28 \triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 3) \vee (i = 4)]$
 $b29 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 3) \vee (i = 4)]$
 $b30 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 4)]$
 $b31 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 4)]$
 $b32 \triangleq [i \in 0 \dots 63 \mapsto (i = 5)]$
 $b33 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 5)]$
 $b34 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 5)]$
 $b35 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 5)]$
 $b36 \triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 5)]$
 $b37 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 5)]$
 $b38 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 5)]$
 $b39 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 5)]$
 $b40 \triangleq [i \in 0 \dots 63 \mapsto (i = 3) \vee (i = 5)]$
 $b41 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 3) \vee (i = 5)]$
 $b42 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 3) \vee (i = 5)]$
 $b43 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 3) \vee (i = 5)]$
 $b44 \triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 3) \vee (i = 5)]$
 $b45 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 3) \vee (i = 5)]$
 $b46 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 5)]$
 $b47 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 5)]$
 $b48 \triangleq [i \in 0 \dots 63 \mapsto (i = 4) \vee (i = 5)]$
 $b49 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 4) \vee (i = 5)]$
 $b50 \triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 4) \vee (i = 5)]$
 $b51 \triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 4) \vee (i = 5)]$

5

6

8

[illegible]

10

[illegible]

[illegible]

14

$$\begin{aligned}
b502 &\triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b503 &\triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b504 &\triangleq [i \in 0 \dots 63 \mapsto (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b505 &\triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b506 &\triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b507 &\triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b508 &\triangleq [i \in 0 \dots 63 \mapsto (i = 2) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b509 &\triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 2) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b510 &\triangleq [i \in 0 \dots 63 \mapsto (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b511 &\triangleq [i \in 0 \dots 63 \mapsto (i = 0) \vee (i = 1) \vee (i = 2) \vee (i = 3) \vee (i = 4) \vee (i = 5) \vee (i = 6) \vee (i = 7) \vee (i = 8)] \\
b512 &\triangleq [i \in 0 \dots 63 \mapsto (i = 9)]
\end{aligned}$$

$$\begin{aligned} BIN &\triangleq [b \in \{\text{TRUE}, \text{FALSE}\} \mapsto \text{IF } b \text{ THEN } 1 \text{ ELSE } 0] \\ BIN32 &\triangleq [f \in BV32 \mapsto BIN[f[0]] * 2^0 + BIN[f[1]] * 2^1 + BIN[f[2]] * 2^2 + BIN[f[3]] * 2^3 + BIN[f[4]] * 2^4 + \dots] \end{aligned}$$

$$SLR32 \triangleq [f \in BV32 \mapsto [g \in BV32 \mapsto [i \in 0..31 \mapsto$$

$$(CMP32[AND32[f][b31]][b31] \wedge$$

$$(i = 0) \wedge g[31]$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b30] \wedge$$

$$(((i = 0) \wedge g[30]) \vee ((i = 1) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b29] \wedge$$

$$(((i = 0) \wedge g[29]) \vee ((i = 1) \wedge g[30]) \vee ((i = 2) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b28] \wedge$$

$$(((i = 0) \wedge g[28]) \vee ((i = 1) \wedge g[29]) \vee ((i = 2) \wedge g[30]) \vee ((i = 3) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b27] \wedge$$

$$(((i = 0) \wedge g[27]) \vee ((i = 1) \wedge g[28]) \vee ((i = 2) \wedge g[29]) \vee ((i = 3) \wedge g[30]) \vee ((i = 4) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b26] \wedge$$

$$(((i = 0) \wedge g[26]) \vee ((i = 1) \wedge g[27]) \vee ((i = 2) \wedge g[28]) \vee ((i = 3) \wedge g[29]) \vee ((i = 4) \wedge g[30]) \vee ((i = 5) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b25] \wedge$$

$$(((i = 0) \wedge g[25]) \vee ((i = 1) \wedge g[26]) \vee ((i = 2) \wedge g[27]) \vee ((i = 3) \wedge g[28]) \vee ((i = 4) \wedge g[29]) \vee ((i = 5) \wedge g[30]) \vee ((i = 6) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b24] \wedge$$

$$(((i = 0) \wedge g[24]) \vee ((i = 1) \wedge g[25]) \vee ((i = 2) \wedge g[26]) \vee ((i = 3) \wedge g[27]) \vee ((i = 4) \wedge g[28]) \vee ((i = 5) \wedge g[29]) \vee ((i = 6) \wedge g[30]) \vee ((i = 7) \wedge g[31])))$$

$$) \vee$$

$$(CMP32[AND32[f][b31]][b23] \wedge$$

$$(((i = 0) \wedge g[23]) \vee ((i = 1) \wedge g[24]) \vee ((i = 2) \wedge g[25]) \vee ((i = 3) \wedge g[26]) \vee ((i = 4) \wedge g[27]) \vee ((i = 5) \wedge g[28]) \vee ((i = 6) \wedge g[29]) \vee ((i = 7) \wedge g[30]) \vee ((i = 8) \wedge g[31])))$$

$$) \vee$$

111

$$\begin{aligned}
& \textcolor{brown}{xR12[15, 22]} \\
\textcolor{brown}{xR12_15_22} &\triangleq [i \in 0..63 \mapsto ((i = 0) \wedge \textcolor{brown}{xR12[15]}) \vee ((i = 1) \wedge \textcolor{brown}{xR12[16]}) \vee ((i = 2) \wedge \textcolor{brown}{xR12[17]}) \vee ((i = 3) \wedge \textcolor{brown}{xR12[18]}) \\
& \textcolor{brown}{xR12[28, 31]} \\
\textcolor{brown}{xR12_28_31} &\triangleq [i \in 0..63 \mapsto ((i = 0) \wedge \textcolor{brown}{xR12[28]}) \vee ((i = 1) \wedge \textcolor{brown}{xR12[29]}) \vee ((i = 2) \wedge \textcolor{brown}{xR12[30]}) \vee ((i = 3) \wedge \textcolor{brown}{xR12[31]}) \\
& \textcolor{brown}{xR12[32, 39]} \\
\textcolor{brown}{xR12_32_39} &\triangleq [i \in 0..63 \mapsto ((i = 0) \wedge \textcolor{brown}{xR12[32]}) \vee ((i = 1) \wedge \textcolor{brown}{xR12[33]}) \vee ((i = 2) \wedge \textcolor{brown}{xR12[34]}) \vee ((i = 3) \wedge \textcolor{brown}{xR12[35]}) \\
& \textcolor{brown}{xR13[32, 63]} \\
\textcolor{brown}{xR13_32_63} &\triangleq [i \in 0..63 \mapsto ((i = 0) \wedge \textcolor{brown}{xR13[32]}) \vee ((i = 1) \wedge \textcolor{brown}{xR13[33]}) \vee ((i = 2) \wedge \textcolor{brown}{xR13[34]}) \vee ((i = 3) \wedge \textcolor{brown}{xR13[35]}) \\
& \textcolor{brown}{RCF[3, 4]} \\
\textcolor{brown}{RCF_3_4} &\triangleq [i \in 0..63 \mapsto ((i = 0) \wedge \textcolor{brown}{RCF[3]}) \vee ((i = 1) \wedge \textcolor{brown}{RCF[4]})] \\
& (\textcolor{brown}{0} \textcolor{brown}{xR12[15, 22]} \textcolor{brown}{2}) \\
\textcolor{brown}{zero_gte_xR12_15_22_lte_two} &\triangleq \textcolor{brown}{CMP64[xR12_15_22][b0]} \vee \textcolor{brown}{CMP64[xR12_15_22][b1]} \vee \textcolor{brown}{CMP64[xR12_15_22][b2]}
\end{aligned}$$

$xR11 \triangleq [i \in 0 \dots 63 \mapsto$

(
 $\text{ } xR11[0, 31]$
 $((i \geq 0) \wedge (i \leq 31)) \wedge$
 (
 $\text{ } (xR8 = 69) \wedge (xR13[0, 31])$
 $(CMP64[xR8][b69] \wedge xR13[i]) \vee$
 $\text{ } (xR8 = 194) \wedge [(0 \ xR12[15, 22] \ 2) \wedge (xR12[28, 31]) \vee (xR12[15, 22] = 59) \wedge (xR12[32, 39])]$
 $(CMP64[xR8][b194] \wedge ((zero_gte_xR12_15_22_lte_two \wedge xR12_28_31[i]) \vee (CMP64[xR12_15_22][b59]$
 $\text{ } (xR8 = 192) \wedge (xR12[15, 22] = 32) \wedge xR13[32, 63]$
 $(CMP64[xR8][b192] \wedge CMP64[xR12_15_22][b32] \wedge xR13_32_63[i]) \vee$
 $\text{ } (xR8 = 128) \wedge (RCF[3, 4] = 0) \wedge MEM[RIP]$
 $(CMP64[xR8][b128] \wedge CMP64[RCF_3_4][b0] \wedge MEM[BIN32[RIP]][i]) \vee$
 $\text{ } \neg(xR8 = 69) \wedge \neg(xR8 = 192) \wedge \neg(xR8 = 194) \wedge \neg(xR8 = 128) \wedge xR11[0, 31]$
 $(\neg CMP64[xR8][b69] \wedge \neg CMP64[xR8][b194] \wedge \neg CMP64[xR8][b192] \wedge \neg CMP64[xR8][b128] \wedge xR11[i]$
)
)
)
 (
 $\text{ } xR11[32, 63]$
 $((i \geq 32) \wedge (i \leq 63)) \wedge$
 (
 $\text{ } (xR8 = 128) \wedge (RCF[3, 4] = 0) \wedge MEM[RIP]$
 $(CMP64[xR8][b128] \wedge CMP64[RCF_3_4][b0] \wedge MEM[BIN32[RIP]][i]) \vee$
 $\text{ } \neg(xR8 = 128) \wedge (xR11$
 $(\neg CMP64[xR8][b128] \wedge xR11[i])$
)
)
)]

$INSTRUCTION_FORMAT_CORRECT :=$

[
 $\text{ } [0 \ xR11[0, 8] \ 2] [(xR11[23, 27] \triangleq 1) + (xR11[23, 27] \triangleq 2) + (xR11[23, 27] \triangleq 4) +$
 $\text{ } (xR11[23, 27] \triangleq 8)] [xR11[59, 64] \triangleq 0] +$
 $\text{ } [9 \ xR11[0, 8] \ 10] [xR11[50, 64] \triangleq 0] + [17 \ xR11[0, 8] \ 33] [xR11[18, 64] \triangleq 0] +$
 $\text{ } [xR11[0, 8] \triangleq 44] [xR11[45, 64] \triangleq 0] +$
 $\text{ } [51 \ xR11[0, 8] \ 53] [xR11[13, 64] \triangleq 0] + [xR11[0, 8] \triangleq 59] [xR11[16, 64] \triangleq 0] + [60$
 $\text{ } xR11[0, 8] \ 67] [xR11[40, 64] \triangleq 0] +$
 $\text{ } [76 \ xR11[0, 8] \ 78] [xR11[8, 64] \triangleq 0]$
]

$\text{ } xR11[0, 7]$
 $xR11_0_7 \triangleq [i \in 0 \dots 63 \mapsto (i \geq 0) \wedge (i \leq 7) \wedge xR11[i]]$

$\text{ } xR11[8, 63]$
 $xR11_8_63 \triangleq [i \in 0 \dots 63 \mapsto ((i = 0) \wedge xR11[8]) \vee ((i = 1) \wedge xR11[9]) \vee ((i = 2) \wedge xR11[10]) \vee ((i = 3) \wedge xR11[11]) \vee$
 $\text{ } xR11[13, 63]$

$\{(xR8 \triangleq 66) \mid (xR8 \triangleq 32)][xR12[1, 2]]\}$
 $xR12[2, 3] = \{[xR8 \triangleq 32][(xR13[(xR8)(31)])(xR14[(xR8)(31)]) + (xR12[1, 2])(xR13[(xR8)(31)]) + (xR14[(xR8)(31)])]\} + \{[33 \ xR8 \ 63][(xR13[(xR8)(31)])(xR14[(xR8)(31)]) + (xR12[2, 3])(xR13[(xR8)(31)]) + (xR14[(xR8)(31)])]\} + \{(xR8 \triangleq 64) \mid (2 \ xR8 \ 31) \mid (xR8 \triangleq 71)][xR12[2, 3]]\}$
 $xR12[3, 4] = \{(xR8 \triangleq 66)(xR13[31, 32])\} + \{(32 \ xR8 \ 64)(xR12[3, 4])\}$
 $xR12[4, 5] = \{(xR8 \triangleq 66)(xR14[31, 32])\} + (32 \ xR8 \ 64) (xR12[4, 5])$
 $xR12[5, 6] = \{(xR8 \triangleq 67) \neg (xR11[0, 32] \triangleq 0) \neg (xR15[0, 32] \triangleq 0) \neg (xR11[0, 32] \triangleq 1) \neg (xR15[0, 32] \triangleq 1)(xR11[31, 32])\} + \{\neg (xR8 \triangleq 67)(xR12[5, 6])\}$
 $xR12[6, 7] = \{(xR8 \triangleq 67) \neg (xR11[0, 32] \triangleq 0) \neg (xR15[0, 32] \triangleq 0) \neg (xR11[0, 32] \triangleq 1) \neg (xR15[0, 32] \triangleq 1)(xR15[31, 32])\} + \{\neg (xR8 \triangleq 67)(xR12[6, 7])\}$
 $xR12[7, 8] = \{(xR8 \triangleq 193)(xR12[63, 64])\} + \{[xR8 \triangleq 67] \neg (xR11[0, 32] \triangleq 0) \neg (xR11[0, 32] \triangleq 1)(xR15[0, 32] \triangleq 1)(xR11[31, 32]) + \neg (xR15[0, 32] \triangleq 0) \neg (xR15[0, 32] \triangleq 1)(xR11[0, 32] \triangleq 1)(xR15[31, 32])\} + \{(xR8 \triangleq 73)(xR13[31, 32])\} + \{[xR8 \triangleq 66] \neg [xR12[1, 2]] \neg (xR13[0, 32] \triangleq 0)(xR14[0, 32] \triangleq 0)(xR13[31, 32]) + (xR13[0, 32] \triangleq 0) \neg (xR14[0, 32] \triangleq 0)(xR14[31, 32])\} + \{[xR8 \triangleq 64] \neg [(xR13[31, 32]) \neg (xR12[3, 4]) \neg (xR12[4, 5]) + \neg (xR13[31, 32])(xR12[3, 4])(xR12[4, 5])][xR13[31, 32]]\} + \{\neg (xR8 \triangleq 64) \neg (xR8 \triangleq 66) \neg (xR8 \triangleq 67) \neg (xR8 \triangleq 73) \neg (xR8 \triangleq 193)(xR12[7, 8])\}$
 $xR12[9, 10] = \{(xR8 \triangleq 193)(xR12[32, 64] \triangleq 0)\} + \{[xR8 \triangleq 67] [(xR11[0, 32] \triangleq 0) + (xR15[0, 32] \triangleq 0)]\} + \{(xR8 \triangleq 73)(xR13[0, 32] \triangleq 0)\} + \{(xR8 \triangleq 66)(xR13[0, 32] \triangleq 0)(xR14[0, 32] \triangleq 0)\} + \{[xR8 \triangleq 64] \neg [(xR13[31, 32]) \neg (xR12[3, 4]) \neg (xR12[4, 5]) + \neg (xR13[31, 32])(xR12[3, 4])(xR12[4, 5])][xR13[31, 32]][xR13[0, 32] \triangleq 0]\} + \{\neg (xR8 \triangleq 64) \neg (xR8 \triangleq 66) \neg (xR8 \triangleq 67) \neg (xR8 \triangleq 73) \neg (xR8 \triangleq 193)(xR12[9, 10])\}$
 $xR12[15, 23] = \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[0, 8])\} + \{\neg (xR8 \triangleq 160)(xR12[15, 23])\}$
 $xR12[23, 28] = \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[8, 13])\} + \{\neg (xR8 \triangleq 160)(xR12[23, 28])\}$
 $xR12[28, 32] = \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[23, 27])\} + \{\neg (xR8 \triangleq 160)(xR12[28, 32])\}$
 $xR12[32, 64] = \{[xR8 \triangleq 224][(xR12[15, 23] \triangleq 0) + (xR12[15, 23] \triangleq 9)][0 \ xR12[32, 64] \ 0x2000000][(0 \ xR12[32, 64] \ 0x2000000)(xR12[32, 64])]mem\} + \{(xR8 \triangleq 225)(xR12[15, 23] \triangleq 59)[xR12[32, 64](xR8 \triangleq 225)(xR12[15, 23] \triangleq 59)]mem\} + \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[8, 40])\} + \{[xR8 \triangleq 167][(xR11[0, 8] \triangleq 44)(xR11[13, 45]) + (9 \ xR11[0, 8] < 10)(xR11[18, 50]) + (0 \ xR11[0, 8] < 2)(xR11[27, 59])]\} +$

$$\begin{aligned}
& \{(xR8 \stackrel{\triangle}{=} 194) \neg (xR12[15, 23] \stackrel{\triangle}{=} 33) \neg (xR12[15, 23] \stackrel{\triangle}{=} 59) \neg (xR12[15, 23] \stackrel{\triangle}{=} 60) (xR13[0, 32])\} + \\
& \{(xR8 \stackrel{\triangle}{=} 192) [(xR12[15, 23] \stackrel{\triangle}{=} 24) (xR13[32, 64]) (xR14[32, 64]) + (xR12[15, 23] \stackrel{\triangle}{=} 25) ((xR13[32, 64]) + (xR14[32, 64])) + (xR12[15, 23] \stackrel{\triangle}{=} 26) ((xR13[32, 64]) \neg (xR14[32, 64]) + \\
& \neg (xR13[32, 64]) (xR14[32, 64])) + (xR12[15, 23] \stackrel{\triangle}{=} 27) ((xR13[32, 64]) ((xR14[32, 64]) (31))) + \\
& (xR12[15, 23] \stackrel{\triangle}{=} 28) ((xR13[32, 64]) ((xR14[32, 64]) (31))) + (xR12[15, 23] \stackrel{\triangle}{=} 29) ((xR13[32, 64]) > ((xR14[32, 64]) (31))) + (xR12[15, 23] \stackrel{\triangle}{=} 51) \neg (xR13[32, 64])]\} \\
& \{[(xR8 \stackrel{\triangle}{=} 196) + (xR8 \stackrel{\triangle}{=} 197)] xR13[0, 32]\} + \\
& \{\neg (xR8 \stackrel{\triangle}{=} 160) \neg (xR8 \stackrel{\triangle}{=} 167) \neg (xR8 \stackrel{\triangle}{=} 192) \neg (xR8 \stackrel{\triangle}{=} 194) \neg (xR8 \stackrel{\triangle}{=} 196) \neg (xR8 \stackrel{\triangle}{=} 197) \neg (xR8 \stackrel{\triangle}{=} 224) \neg (xR8 \stackrel{\triangle}{=} 225) (xR12[32, 64])\}
\end{aligned}$$

$$xR12 \stackrel{\triangle}{=} [i \in 0 \dots 63 \mapsto$$

(

$$xR12[0]$$

$$(i = 0) \wedge$$

(

$$[xR8 = 192] \wedge [(xR12[15, 22] = 31) \vee (xR12[15, 22] = 33) \vee (xR12[15, 22] = 52) \vee (59 \ xR12[15, 22] \ 60)]$$

$$(CMP64[xR8][b192] \wedge (CMP64[xR12_15_22][b31] \vee CMP64[xR12_15_22][b33] \vee CMP64[xR12_15_22][b35]))$$

$$(xR8 = 68) \vee (xR8 = 69) \vee (xR8 = 72)$$

$$(CMP64[xR8][b68] \vee CMP64[xR8][b69] \vee CMP64[xR8][b72]) \vee$$

$$(xR8 = 65) \wedge (xR12[0])$$

$$(CMP64[xR8][b65] \wedge xR12[0])$$

)

) \vee

(

$$xR12[1]$$

$$(i = 1) \wedge$$

(

)

)

$$xR12[0, 1] = \{(xR8 \stackrel{\triangle}{=} 192) [(xR12[15, 23] \stackrel{\triangle}{=} 31) + (xR12[15, 23] \stackrel{\triangle}{=} 33) + (xR12[15, 23] \stackrel{\triangle}{=} 52) + (59 \ xR12[15, 23] \ 60)]\} +$$

$$\{(xR8 \stackrel{\triangle}{=} 68)\} + \{(xR8 \stackrel{\triangle}{=} 69)\} + \{(xR8 \stackrel{\triangle}{=} 72)\} +$$

$$\{(xR8 \stackrel{\triangle}{=} 65) (xR12[0, 1])\}$$

$$xR12[1, 2] = \{[2 \ xR8 \ 31] [\neg (xR13[0, 32] \stackrel{\triangle}{=} 0) + (xR12[2, 3]) [xR12[2, 3]] +$$

$$\{(xR8 \stackrel{\triangle}{=} 65) (xR12[0, 1] + xR12[1, 2])\} +$$

$$\{(33 \ xR8 \ 63) (xR12[2, 3])\} +$$

$$\{[(xR8 \stackrel{\triangle}{=} 66) | (xR8 \stackrel{\triangle}{=} 32)] [xR12[1, 2]]\}$$

$$xR12[2, 3] = \{(xR8 \stackrel{\triangle}{=} 32) [(xR13[(xR8)(31)]) (xR14[(xR8)(31)]) + (xR12[1, 2]) ((xR13[(xR8)(31)]) + (xR14[(xR8)(31)]))] \} +$$

$$\{(33 \ xR8 \ 63) [(xR13[(xR8)(31)]) (xR14[(xR8)(31)]) + (xR12[2, 3]) ((xR13[(xR8)(31)]) + (xR14[(xR8)(31)]))] \} +$$

$$\{[(xR8 \stackrel{\triangle}{=} 64) | (2 \ xR8 \ 31) | (xR8 \stackrel{\triangle}{=} 71)] [xR12[2, 3]]\}$$

$$\begin{aligned}
xR12[3, 4] &= \{(xR8 \triangleq 66)(xR13[31, 32])\} + \\
&\{(32 \ xR8 \ 64)(xR12[3, 4])\} \\
xR12[4, 5] &= \{(xR8 \triangleq 66)(xR14[31, 32])\} + \\
&(32 \ xR8 \ 64) (xR12[4, 5]) \\
xR12[5, 6] &= \{(xR8 \triangleq 67) \neg(xR11[0, 32] \triangleq 0) \neg(xR15[0, 32] \triangleq 0) \neg(xR11[0, 32] \triangleq 1) \neg(xR15[0, 32] \triangleq 1)(xR11[31, 32])\} + \\
&\{\neg(xR8 \triangleq 67)(xR12[5, 6])\} \\
xR12[6, 7] &= \{(xR8 \triangleq 67) \neg(xR11[0, 32] \triangleq 0) \neg(xR15[0, 32] \triangleq 0) \neg(xR11[0, 32] \triangleq 1) \neg(xR15[0, 32] \triangleq 1)(xR15[31, 32])\} + \\
&\{\neg(xR8 \triangleq 67)(xR12[6, 7])\} \\
xR12[7, 8] &= \{(xR8 \triangleq 193)(xR12[63, 64])\} + \\
&\{[xR8 \triangleq 67][\neg(xR11[0, 32] \triangleq 0) \neg(xR11[0, 32] \triangleq 1)(xR15[0, 32] \triangleq 1)(xR11[31, 32]) + \\
&\neg(xR15[0, 32] \triangleq 0) \neg(xR15[0, 32] \triangleq 1)(xR11[0, 32] \triangleq 1)(xR15[31, 32])]\} + \\
&\{(xR8 \triangleq 73)(xR13[31, 32])\} + \\
&\{[xR8 \triangleq 66] \neg[xR12[1, 2]] \neg(xR13[0, 32] \triangleq 0)(xR14[0, 32] \triangleq 0)(xR13[31, 32]) + (xR13[0, 32] \triangleq 0) \neg(xR14[0, 32] \triangleq 0)(xR14[31, 32])\} + \\
&\{[xR8 \triangleq 64] \neg[(xR13[31, 32]) \neg(xR12[3, 4]) \neg(xR12[4, 5]) + \\
&\neg(xR13[31, 32])(xR12[3, 4])(xR12[4, 5])[xR13[31, 32]]\} + \\
&\{\neg(xR8 \triangleq 64) \neg(xR8 \triangleq 66) \neg(xR8 \triangleq 67) \neg(xR8 \triangleq 73) \neg(xR8 \triangleq 193)(xR12[7, 8])\} \\
xR12[9, 10] &= \{(xR8 \triangleq 193)(xR12[32, 64] \triangleq 0)\} + \\
&\{[xR8 \triangleq 67][\neg(xR11[0, 32] \triangleq 0) + (xR15[0, 32] \triangleq 0)]\} + \\
&\{(xR8 \triangleq 73)(xR13[0, 32] \triangleq 0)\} + \\
&\{(xR8 \triangleq 66)(xR13[0, 32] \triangleq 0)(xR14[0, 32] \triangleq 0)\} + \\
&\{[xR8 \triangleq 64] \neg[(xR13[31, 32]) \neg(xR12[3, 4]) \neg(xR12[4, 5]) + \\
&\neg(xR13[31, 32])(xR12[3, 4])(xR12[4, 5])[xR13[31, 32]][xR13[0, 32] \triangleq 0]\} + \\
&\{\neg(xR8 \triangleq 64) \neg(xR8 \triangleq 66) \neg(xR8 \triangleq 67) \neg(xR8 \triangleq 73) \neg(xR8 \triangleq 193)(xR12[9, 10])\} \\
xR12[15, 23] &= \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[0, 8])\} + \\
&\{\neg(xR8 \triangleq 160)(xR12[15, 23])\} \\
xR12[23, 28] &= \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[8, 13])\} + \\
&\{\neg(xR8 \triangleq 160)(xR12[23, 28])\} \\
xR12[28, 32] &= \{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[23, 27])\} + \\
&\{\neg(xR8 \triangleq 160)(xR12[28, 32])\} \\
xR12[32, 64] &= \{[xR8 \triangleq 224][\neg(xR12[15, 23] \triangleq 0) + (xR12[15, 23] \triangleq 9)][0 \ xR12[32, 64] \\
&0x20000000][\neg(0 \ xR12[32, 64] \ 0x20000000)(xR12[32, 64])mem]\} + \\
&\{(xR8 \triangleq 225)(xR12[15, 23] \triangleq 59)[xR12[32, 64](xR8 \triangleq 225)(xR12[15, 23] \triangleq 59)]mem\} + \\
&\{(xR8 \triangleq 160)(INSTRUCTION_FORMAT_CORRECT)(xR11[8, 40])\} + \\
&\{[xR8 \triangleq 167][\neg(xR11[0, 8] \triangleq 44)(xR11[13, 45]) + (9 \ xR11[0, 8] < 10)(xR11[18, 50]) + (0 \\
&xR11[0, 8] < 2)(xR11[27, 59])]\} + \\
&\{(xR8 \triangleq 194) \neg(xR12[15, 23] \triangleq 33) \neg(xR12[15, 23] \triangleq 59) \neg(xR12[15, 23] \triangleq 60)(xR13[0, 32])\} +
\end{aligned}$$

$$\begin{aligned}
& \{[xR8 \stackrel{\triangle}{=} 192][xR12[15, 23] \stackrel{\triangle}{=} 24](xR13[32, 64])(xR14[32, 64]) + (xR12[15, 23] \stackrel{\triangle}{=} 25)((xR13[32, 64]) + (xR14[32, 64])) + (xR12[15, 23] \stackrel{\triangle}{=} 26)((xR13[32, 64])\neg(xR14[32, 64]) + \\
& \neg(xR13[32, 64])(xR14[32, 64])) + (xR12[15, 23] \stackrel{\triangle}{=} 27)((xR13[32, 64])((xR14[32, 64])(31))) + \\
& (xR12[15, 23] \stackrel{\triangle}{=} 28)((xR13[32, 64])((xR14[32, 64])(31))) + (xR12[15, 23] \stackrel{\triangle}{=} 29)((xR13[32, 64])) > ((xR14[32, 64])(31))) + (xR12[15, 23] \stackrel{\triangle}{=} 51)\neg(xR13[32, 64])]\} \\
& \{[(xR8 \stackrel{\triangle}{=} 196) + (xR8 \stackrel{\triangle}{=} 197)][xR13[0, 32]]\} + \\
& \{\neg(xR8 \stackrel{\triangle}{=} 160)\neg(xR8 \stackrel{\triangle}{=} 167)\neg(xR8 \stackrel{\triangle}{=} 192)\neg(xR8 \stackrel{\triangle}{=} 194)\neg(xR8 \stackrel{\triangle}{=} 196)\neg(xR8 \stackrel{\triangle}{=} 197)\neg(xR8 \stackrel{\triangle}{=} 224)\neg(xR8 \stackrel{\triangle}{=} 225)(xR12[32, 64])\} \\
\\
& xR13[0, 1] := \{(xR8 = 256) \vee (xR8 = 257)\} \vee \\
& (xR8 = 165) \wedge 0 \\
& (xR8 = 163) \wedge 0 \\
& (xR8 = 161) \wedge 0 \\
\\
& xR13[1, 6] := \{[(xR8 = 256) \vee (xR8 = 257)] \wedge xR12[23, 28]\} \vee \\
& \{(xR8 = 165) \wedge xR11[18, 23]\} \vee \\
& \{(xR8 = 163) \wedge xR11[13, 18]\} \vee \\
& \{(xR8 = 161) \wedge xR11[8, 13]\} \vee \\
\\
& xR13[0, 32] := \{[(xR8 = 192) \wedge ((xR12[15, 23] = 52) \vee (xR12[15, 23] = 53) \vee (xR12[15, 23] = 59) \vee (xR12[15, 23] = 60) \vee (xR12[15, 23] = 76)) \wedge xR14[32, 64]] \vee \\
& \{[(xR8 = 192) \wedge ((xR12[15, 23] = 30) \vee (xR12[15, 23] = 31) \vee (xR12[15, 23] = 33))] \wedge xR13[32, 64]\} \vee \\
& \{[(xR8 = 192) \wedge ((xR12[15, 23] = 0) \vee (xR12[15, 23] = 1) \vee (xR12[15, 23] = 2) \vee (xR12[15, 23] = 9) \vee (xR12[15, 23] = 10))] \wedge xR12[32, 64]\} \vee \\
& \{(xR8 = 128) \wedge RIP\} \vee \\
& \{(xR8 = 67) \wedge (xR11[0, 32] = 1) \wedge (xR15[0, 32] = 0) \wedge (xR15[0, 32] = 1) \wedge (xR15[0, 32])\} \vee \\
& \{(xR8 = 67) \wedge (xR15[0, 32] = 1) \wedge (xR11[0, 32] = 0) \wedge (xR11[0, 32] = 1) \wedge (xR11[0, 32])\} \vee \\
& \{(xR8 = 67) \wedge [(xR11[0, 32] = 0) \vee (xR15[0, 32] = 0)] \wedge 0\} \vee \\
& \{(xR8 = 68) \wedge [(xR12[5, 6]) \vee (xR12[5, 6] \wedge xR12[6, 7])] \wedge 0\} \vee \\
& \{(xR8 = 69) \wedge xR12[6, 7] \wedge 0\} \vee \\
& \{(xR8 = 1) \wedge xR15[0, 1] \wedge xR11[0, 32]\} \vee \\
& \{(xR8 = 1) \wedge xR15[0, 1] \wedge xR15[1, 2] \wedge (xR11[0, 32](1))\} \vee \\
& \{(xR8 = 1) \wedge xR15[0, 1] \wedge xR15[1, 2] \wedge 0\} \vee \\
& \{(2 \ xR8 \ 31) \wedge xR15[xR8] \wedge 0\} \vee \\
& \{(2 \ xR8 \ 31) \wedge xR15[xR8] \wedge (xR11[0, 32](xR8))\} \vee \\
& \{(xR8 = 72) \wedge 0\} \vee \\
& \{(xR8 = 66) \wedge (xR13[0, 32] = 0) \wedge (xR14[0, 32] = 0) \wedge xR12[1, 2]\} \vee \\
& \{(xR8 = 66) \wedge (xR13[0, 32] = 0) \wedge (xR14[0, 32] = 0) \wedge xR12[1, 2] \wedge xR14[0, 32]\} \vee \\
& \{(xR8 = 97) \wedge [\\
& ((xR13[1, 6] = 0) \wedge RIP) \vee \\
& ((xR13[1, 6] = 1) \wedge RSP) \vee \\
& ((xR13[1, 6] = 2) \wedge RBP) \vee \\
& ((xR13[1, 6] = 3) \wedge RCF) \vee \\
& ((xR13[1, 6] = 4) \wedge R4) \vee \\
& ((xR13[1, 6] = 5) \wedge R5) \vee \\
& ((xR13[1, 6] = 6) \wedge R6) \vee \\
& ((xR13[1, 6] = 7) \wedge R7) \vee \\
& ((xR13[1, 6] = 8) \wedge R8) \vee \\
& ((xR13[1, 6] = 9) \wedge R9) \vee \\
& ((xR13[1, 6] = 10) \wedge R10) \vee \\
& ((xR13[1, 6] = 11) \wedge R11) \vee
\end{aligned}$$

```

((xR13[1, 6] = 12) ∧ R12) ∨
((xR13[1, 6] = 13) ∧ R13) ∨
((xR13[1, 6] = 14) ∧ R14) ∨
((xR13[1, 6] = 15) ∧ R15) ∨
((xR13[1, 6] = 16) ∧ R16) ∨
((xR13[1, 6] = 17) ∧ R17) ∨
((xR13[1, 6] = 18) ∧ R18) ∨
((xR13[1, 6] = 19) ∧ R19) ∨
((xR13[1, 6] = 20) ∧ R20) ∨
((xR13[1, 6] = 21) ∧ R21) ∨
((xR13[1, 6] = 22) ∧ R22) ∨
((xR13[1, 6] = 23) ∧ R23) ∨
((xR13[1, 6] = 24) ∧ R24) ∨
((xR13[1, 6] = 25) ∧ R25) ∨
((xR13[1, 6] = 26) ∧ R26) ∨
((xR13[1, 6] = 27) ∧ R27) ∨
((xR13[1, 6] = 28) ∧ R28) ∨
((xR13[1, 6] = 29) ∧ R29) ∨
((xR13[1, 6] = 30) ∧ R30) ∨
((xR13[1, 6] = 31) ∧ R31)]}

xR13[0] := {(xR8 = 32) ∧ [(xR12[1] ∧ xR13[0] ∧ xR14[0]) ∨ (xR12[1] ∧ xR13[0] ∧ xR14[0]) ∨
(xR12[1] ∧ xR13[0] ∧ xR14[0]) ∨ (xR12[1] ∧ xR13[0] ∧ xR14[0])]}

xR13[xR8 ∧ 31] := {(33 xR8 63) ∧
[(xR12[2] ∧ xR13[xR8 ∧ 31] ∧ xR14[xR8 ∧ 31]) ∨
(xR12[2] ∧ xR13[xR8 ∧ 31] ∧ xR14[xR8 ∧ 31]) ∨
(xR12[2] ∧ xR13[xR8 ∧ 31] ∧ xR14[xR8 ∧ 31]) ∨
(xR12[2] ∧ xR13[xR8 ∧ 31] ∧ xR14[xR8 ∧ 31])]}

xR13[32, 64] := {[(xR8 = 194) ∧ ((xR12[15, 23] = 59) ∨ (xR12[15, 23] = 60))] ∧ xR13[0, 32]}
{(xR8 = 162) ∧ xR13[0, 32]}

xR14[0, 32] := {(xR8 = 256) ∧ [(xR12[15, 23] = 0) ∨ (xR12[15, 23] = 2) ∨
(xR12[15, 23] = 9) ∨ (24 xR12[15, 23] 32) ∨
(xR12[15, 23] = 44) ∨ (xR12[15, 23] = 51)] ∧ xR12[32, 64]} ∨
{(xR8 = 256) ∧ (17 xR12[15, 23] 23) ∧ xR14[32, 64]} ∨
{(xR8 = 257) ∧ (xR12[15, 23] = 53) ∧ xR15[32, 64]} ∨
{(xR8 = 192) ∧ [(0 xR12[15, 23] 2) ∨ (xR12[15, 23] = 9) ∨ (xR12[15, 23] = 10)
∨ (xR12[15, 23] = 30) ∨ (xR12[15, 23] = 31) ∨ (xR12[15, 23] = 33)] ∧ xR14[32, 64]} ∨
{(xR8 = 192) ∧ [(xR12[15, 23] = 52) ∨ (xR12[15, 23] = 53) ∨ (xR12[15, 23] = 59)
∨ (xR12[15, 23] = 60) ∨ (xR12[15, 23] = 76)] ∧ 4} ∨
{(xR8 = 195) ∧ (0 xR12[15, 23] 2) ∧ xR12[32, 64]} ∨
{(xR8 = 195) ∧ (xR12[15, 23] = 59) ∧ INTERRUPT_TABLE} ∨
{(xR8 = 128) ∧ 8} ∨
{(xR8 = 68) ∧ xR12[5, 6] ∧ xR12[6, 7] ∧ xR15[0, 32]} ∨
{(xR8 = 68) ∧ xR12[5, 6] ∧ xR11[0, 32]} ∨
{(xR8 = 69) ∧ xR12[6, 7] ∧ xR15[0, 32]} ∨
{(xR8 = 1) ∧ xR15[0] ∧ xR15[1] ∧ (xR11[0, 32]⟨1⟩)} ∨
{(2 xR8 31) ∧ [(xR13[0, 32] = 0) ∨ xR12[2]] ∧ xR15[xR8] ∧ (xR11[0, 32]⟨xR8⟩)} ∨
{(2 xR8 31) ∧ [(xR13[0, 32] = 0) ∨ xR12[2]] ∧ xR15[xR8] ∧ 0} ∨

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{(xR8 = 71) ∧ xR12[2] ∧ xR13[31] ∧ [(xR12[5] ∧ xR12[6]) ∨ (xR12[5] ∧ xR12[6])] ∧ xR13[0, 32]} ∨
{(xR8 = 65) ∧ [(xR14[0, 32] ∧ xR12[0]) ∨ (xR14[0, 32] ∧ xR12[0])]} ∨

xR14[32, 64] := {(xR8 = 164) ∧ xR13[0, 32]} ∨
{(xR8 = 167) ∧ [(xR11[0, 8] = 52) ∨ (xR11[0, 8] = 53) ∨ (xR11[0, 8] = 59) ∨
(xR11[0, 8] = 60) ∨ (xR11[0, 8] = 76)] ∧ RSP} ∨

xR15[0, 32] := {(xR8 = 192) ∧ (xR12[15, 23] = 32) ∧ xR14[32, 64]} ∨
{(xR8 = 194) ∧ (xR12[15, 23] = 59) ∧ 4} ∨
{(xR8 = 194) ∧ [(0 xR12[15, 23] 2)] ∧ xR15[32, 64]} ∨
{(xR8 = 70) ∧ xR13[0, 32]} ∨

xR15[32, 64] := {(xR8 = 224) ∧ [(xR12[15, 23] = 53) ∨ (xR12[15, 23] = 76)] ∧
(STACK_MIN xR12[32, 64] STACK_MAX) ∧ MEM[xR12[32, 64]]} ∨
{(xR8 = 166) ∧ xR13[0, 32]} ∨
{(xR8 = 167) ∧ [(xR12[15, 23] = 52) ∨ (xR12[15, 23] = 53) ∨
(xR12[15, 23] = 59) ∨ (xR12[15, 23] = 60) ∨ (xR12[15, 23] = 76)] ∧ RIP} ∨

RIP := {(xR8 = 256) ∧ [(xR12[15, 23] = 63) ∨ (xR12[15, 23] = 65) ∨ (xR12[15, 23] = 66)]
∧ RCF[2] ∧ xR12[32, 64]} ∨
{(xR8 = 256) ∧ [(xR12[15, 23] = 62) ∨ (xR12[15, 23] = 63) ∨ (xR12[15, 23] = 67)]
∧ RCF[0] ∧ xR12[32, 64]} ∨
{(xR8 = 256) ∧ [(xR12[15, 23] = 64) ∨ (xR12[15, 23] = 65) ∨ (xR12[15, 23] = 67)]
∧ RCF[0] ∧ RCF[2] ∧ xR12[32, 64]} ∨
{(xR8 = 257) ∧ (59 xR12[15, 23] 61) ∧ xR12[32, 64]} ∨
{(xR8 = 257) ∧ (xR12[15, 23] = 76) ∧ xR15[32, 64]} ∨
{(xR8 = 98) ∧ [(xR13[1, 6] = 0) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 0) ∧ RIP]} ∨
{(xR8 = 129) ∧ xR13[0, 32]} ∨

RSP := {(xR8 = 256) ∧ [(xR12[15, 23] = 52) ∨ (xR12[15, 23] = 53) ∨ (xR12[15, 23] = 76)]
∧ xR12[32, 64]} ∨
{(xR8 = 256) ∧ [(xR12[15, 23] = 59) ∨ (xR12[15, 23] = 60)] ∧ xR13[32, 64]} ∨
{(xR8 = 98) ∧ [(xR13[1, 6] = 1) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 1) ∧ RSP]} ∨

RBP := {(xR8 = 98) ∧ [(xR13[1, 6] = 2) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 2) ∧ RBP]} ∨

RCF := {(xR8 = 98) ∧ [(xR13[1, 6] = 3) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 3) ∧ RCF]} ∨

RCF[3, 5] := {(xR8 = 224) ∧ [(xR12[15, 23] = 0) ∨ (xR12[15, 23] = 1) ∨ (xR12[15, 23] = 9) ∨
(xR12[15, 23] = 10)] ∧ (MEM_MIN xR12[32, 64] MEM_MAX) ∧ 3} ∨
{(xR8 = 224) ∧ [(xR12[15, 23] = 53) ∨ (xR12[15, 23] = 76)]
∧ (STACK_MIN xR12[32, 64] STACK_MAX) ∧ 3} ∨
{(xR8 = 224) ∧ [(xR12[15, 23] = 52) ∨ (xR12[15, 23] = 59) ∨ (xR12[15, 23] = 60)]
∧ (STACK_MIN xR14[32, 64] STACK_MAX) ∧ 3} ∨
{(xR8 = 258) ∧ 0} ∨
{(xR8 = 64) ∧ [(xR13[31] ∧ xR12[3] ∧ xR12[4]) ∨ (xR13[31] ∧ xR12[3] ∧ xR12[4])] ∧ 1} ∨
{(xR8 = 71) ∧ (xR12[2] ∨ xR13[31]) ∧ 1} ∨
{(xR8 = 160) ∧ ¬INSTRUCTION_FORMAT_CORRECT ∧ 2} ∨
{(xR8 = 161) ∧ (xR11[0, 8] = 77) ∧ 0} ∨

RCF[0] := {(xR8 = 258) ∧ [(24 xR12[15, 23] 33) ∨ (xR12[15, 23] = 51)] ∧ xR12[7]} ∨
{(xR8 = 258) ∧ [(24 xR12[15, 23] 33) ∧ (xR12[15, 23] = 51)] ∧ 0} ∨

RCF[2] := {(xR8 = 258) ∧ [(24 xR12[15, 23] 33) ∨ (xR12[15, 23] = 51)] ∧ xR12[9]} ∨
{(xR8 = 258) ∧ [(24 xR12[15, 23] 33) ∧ (xR12[15, 23] = 51)] ∧ 0} ∨

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R4 := {(xR8 = 98) ∧ [(xR13[1, 6] = 4) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 4) ∧ R4]} ∨
R5 := {(xR8 = 98) ∧ [(xR13[1, 6] = 5) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 5) ∧ R5]} ∨
R6 := {(xR8 = 98) ∧ [(xR13[1, 6] = 6) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 6) ∧ R6]} ∨
R7 := {(xR8 = 98) ∧ [(xR13[1, 6] = 7) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 7) ∧ R7]} ∨
R8 := {(xR8 = 98) ∧ [(xR13[1, 6] = 8) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 8) ∧ R8]} ∨
R9 := {(xR8 = 98) ∧ [(xR13[1, 6] = 9) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 9) ∧ R9]} ∨
R10 := {(xR8 = 98) ∧ [(xR13[1, 6] = 10) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 10) ∧ R10]} ∨
R11 := {(xR8 = 98) ∧ [(xR13[1, 6] = 11) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 11) ∧ R11]} ∨
R12 := {(xR8 = 98) ∧ [(xR13[1, 6] = 12) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 12) ∧ R12]} ∨
R13 := {(xR8 = 98) ∧ [(xR13[1, 6] = 13) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 13) ∧ R13]} ∨
R14 := {(xR8 = 98) ∧ [(xR13[1, 6] = 14) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 14) ∧ R14]} ∨
R15 := {(xR8 = 98) ∧ [(xR13[1, 6] = 15) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 15) ∧ R15]} ∨
R16 := {(xR8 = 98) ∧ [(xR13[1, 6] = 16) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 16) ∧ R16]} ∨
R17 := {(xR8 = 98) ∧ [(xR13[1, 6] = 17) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 17) ∧ R17]} ∨
R18 := {(xR8 = 98) ∧ [(xR13[1, 6] = 18) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 18) ∧ R18]} ∨
R19 := {(xR8 = 98) ∧ [(xR13[1, 6] = 19) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 19) ∧ R19]} ∨
R20 := {(xR8 = 98) ∧ [(xR13[1, 6] = 20) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 20) ∧ R20]} ∨
R21 := {(xR8 = 98) ∧ [(xR13[1, 6] = 21) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 21) ∧ R21]} ∨
R22 := {(xR8 = 98) ∧ [(xR13[1, 6] = 22) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 22) ∧ R22]} ∨
R23 := {(xR8 = 98) ∧ [(xR13[1, 6] = 23) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 23) ∧ R23]} ∨
R24 := {(xR8 = 98) ∧ [(xR13[1, 6] = 24) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 24) ∧ R24]} ∨
R25 := {(xR8 = 98) ∧ [(xR13[1, 6] = 25) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 25) ∧ R25]} ∨
R26 := {(xR8 = 98) ∧ [(xR13[1, 6] = 26) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 26) ∧ R26]} ∨
R27 := {(xR8 = 98) ∧ [(xR13[1, 6] = 27) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 27) ∧ R27]} ∨
R28 := {(xR8 = 98) ∧ [(xR13[1, 6] = 28) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 28) ∧ R28]} ∨
R29 := {(xR8 = 98) ∧ [(xR13[1, 6] = 29) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 29) ∧ R29]} ∨
R30 := {(xR8 = 98) ∧ [(xR13[1, 6] = 30) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 30) ∧ R30]} ∨
R31 := {(xR8 = 98) ∧ [(xR13[1, 6] = 31) ∧ xR14[0, 32]] ∨ [(xR13[1, 6] = 31) ∧ R31]} ∨
MEMORY[xR14[32, 64]] := {(xR8 = 224) ∧ [(xR12[15, 23] = 59) ∨ (xR12[15, 23] = 60)]
  ∧ (STACK_MIN xR14[32, 64] STACK_MAX) ∧ xR15[32, 64]} ∨
MEMORY[xR12[32, 64]] := {(xR8 = 224) ∧ [(xR12[15, 23] = 1) ∨ (xR12[15, 23] = 10)]
  ∧ (MEM_MIN xR12[32, 64] MEM_MAX) ∧ xR13[32, 64]} ∨
MEMORY[xR14[32, 64]] := {(xR8 = 224) ∧ (xR12[15, 23] = 52) ∧ (STACK_MIN xR14[32, 64]
  STACK_MAX) ∧ xR13[32, 64]} ∨
THEOREM ANDN_CORRECT  $\triangleq$ 

```

$\forall f, g \in BVN : \forall i \in 0 \dots N :$
 $ANDN[f][g][i] \equiv f[i] \wedge g[i]$

PROOF

$\langle 1 \rangle 1$ TAKE $f, g \in BVN$
 $\langle 1 \rangle 2$ TAKE $i \in 0 \dots N$
 $\langle 1 \rangle 3$ $ANDN[f][g][i] \equiv f[i] \wedge g[i]$
 BY DEF BVN , $ANDN$
 $\langle 1 \rangle$ QED BY $\langle 1 \rangle 3$

THEOREM $ORN_CORRECT \triangleq$
 $\forall f, g \in BVN : \forall i \in 0 \dots N :$
 $ORN[f][g][i] \equiv f[i] \vee g[i]$

PROOF

$\langle 1 \rangle 1$ TAKE $f, g \in BVN$
 $\langle 1 \rangle 2$ TAKE $i \in 0 \dots N$
 $\langle 1 \rangle 3$ $ORN[f][g][i] \equiv f[i] \vee g[i]$
 BY DEF BVN , ORN
 $\langle 1 \rangle$ QED BY $\langle 1 \rangle 3$

THEOREM $EXPANDN_CORRECT \triangleq$
 $\forall b \in \{\text{TRUE}, \text{FALSE}\} : \forall i \in 0 \dots N :$
 $EXPANDN[b][i] \equiv b$

PROOF

$\langle 1 \rangle 1$ TAKE $b \in \{\text{TRUE}, \text{FALSE}\}$
 $\langle 1 \rangle 2$ TAKE $i \in 0 \dots N$
 $\langle 1 \rangle 3$ $EXPANDN[b][i] \equiv b$
 BY DEF $EXPANDN$
 $\langle 1 \rangle$ QED BY $\langle 1 \rangle 3$

THEOREM $NOT_XORN_EQ \triangleq$
 $\forall f, g \in BVN : \forall i \in 0 \dots N :$
 $\neg XORN[f][g][i] \equiv f[i] \neq g[i]$

PROOF

$\langle 1 \rangle 1$ TAKE $f, g \in BVN$
 $\langle 1 \rangle 2$ TAKE $i \in 0 \dots N$
 $\langle 1 \rangle 3$ ASSUME $f[i] \neq g[i]$ PROVE $XORN[f][g][i]$
 $\langle 2 \rangle 1$ $f[i] \in \{\text{TRUE}, \text{FALSE}\}$
 BY DEF BVN
 $\langle 2 \rangle 2$ $g[i] \in \{\text{TRUE}, \text{FALSE}\}$
 BY DEF BVN
 $\langle 2 \rangle 3$ $(f[i] \neq g[i]) \Rightarrow ((f[i] \wedge \neg g[i]) \vee (\neg f[i] \wedge g[i]))$
 BY $\langle 2 \rangle 1$, $\langle 2 \rangle 2$
 $\langle 2 \rangle 4$ $((f[i] \wedge \neg g[i]) \vee (\neg f[i] \wedge g[i]))$
 BY $\langle 1 \rangle 3$, $\langle 2 \rangle 3$
 $\langle 2 \rangle 5$ $XORN[f][g][i]$
 BY $\langle 2 \rangle 4$ DEF $XORN$

$\langle 2 \rangle 6$ QED BY $\langle 2 \rangle 5$
 $\langle 1 \rangle 4$ ASSUME $XORN[f][g][i]$ PROVE $(f[i] \neq g[i])$
 $\langle 2 \rangle 7 ((f[i] \wedge \neg g[i]) \vee (\neg f[i] \wedge g[i]))$
 BY $\langle 1 \rangle 4$ DEF $XORN$
 $\langle 2 \rangle 8 f[i] \neq g[i]$
 BY $\langle 2 \rangle 7$
 $\langle 2 \rangle 9$ QED BY $\langle 2 \rangle 8$
 $\langle 1 \rangle$ QED BY $\langle 1 \rangle 3, \langle 1 \rangle 4$

THEOREM $CMP32_F_EQ_G \triangleq$

ASSUME $N = 31$ PROVE
 $\forall f, g \in BVN :$
 $CMP32[f][g] \equiv f = g$

PROOF

$\langle 1 \rangle 1$ TAKE $f, g \in BVN$
 $\langle 1 \rangle 2$ ASSUME $CMP32[f][g]$ PROVE $f = g$
 $\langle 2 \rangle 1$
 $(\neg XORN[f][g][0] \wedge \neg XORN[f][g][1] \wedge \neg XORN[f][g][2] \wedge$
 $\neg XORN[f][g][3] \wedge \neg XORN[f][g][4] \wedge \neg XORN[f][g][5] \wedge$
 $\neg XORN[f][g][6] \wedge \neg XORN[f][g][7] \wedge \neg XORN[f][g][8] \wedge$
 $\neg XORN[f][g][9] \wedge \neg XORN[f][g][10] \wedge \neg XORN[f][g][11] \wedge$
 $\neg XORN[f][g][12] \wedge \neg XORN[f][g][13] \wedge \neg XORN[f][g][14] \wedge$
 $\neg XORN[f][g][15] \wedge \neg XORN[f][g][16] \wedge \neg XORN[f][g][17] \wedge$
 $\neg XORN[f][g][18] \wedge \neg XORN[f][g][19] \wedge \neg XORN[f][g][20] \wedge$
 $\neg XORN[f][g][21] \wedge \neg XORN[f][g][22] \wedge \neg XORN[f][g][23] \wedge$
 $\neg XORN[f][g][24] \wedge \neg XORN[f][g][25] \wedge \neg XORN[f][g][26] \wedge$
 $\neg XORN[f][g][27] \wedge \neg XORN[f][g][28] \wedge \neg XORN[f][g][29] \wedge$
 $\neg XORN[f][g][30] \wedge \neg XORN[f][g][31]) \Rightarrow$
 $(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$
 $f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge$
 $f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge$
 $f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge$
 $f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge$
 $f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge$
 $f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge$
 $f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31])$
 BY NOT_XORN_EQ
 $\langle 2 \rangle 2$
 $(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$
 $f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge$
 $f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge$
 $f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge$
 $f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge$
 $f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge$
 $f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge$

$$\begin{aligned}
& f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31] \Rightarrow \\
& (f = g) \\
& \text{BY DEF BVN} \\
\langle 2 \rangle 3 \quad & f = g \\
& \text{BY } \langle 1 \rangle 2, \langle 2 \rangle 1, \langle 2 \rangle 2 \text{ DEF CMP32} \\
\langle 2 \rangle 4 \quad & \text{QED BY } \langle 2 \rangle 3 \\
\langle 1 \rangle 3 \quad & \text{ASSUME } f = g \text{ PROVE CMP32}[f][g] \\
\langle 2 \rangle 5 \quad & (f = g) \Rightarrow \\
& (f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge \\
& f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge \\
& f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge \\
& f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge \\
& f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge \\
& f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge \\
& f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge \\
& f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31]) \\
& \text{OBVIOUS} \\
\langle 2 \rangle 6 \quad & (f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge \\
& f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge \\
& f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge \\
& f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge \\
& f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge \\
& f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge \\
& f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge \\
& f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31]) \Rightarrow \\
& (\neg \text{XORN}[f][g][0] \wedge \neg \text{XORN}[f][g][1] \wedge \neg \text{XORN}[f][g][2] \wedge \\
& \neg \text{XORN}[f][g][3] \wedge \neg \text{XORN}[f][g][4] \wedge \neg \text{XORN}[f][g][5] \wedge \\
& \neg \text{XORN}[f][g][6] \wedge \neg \text{XORN}[f][g][7] \wedge \neg \text{XORN}[f][g][8] \wedge \\
& \neg \text{XORN}[f][g][9] \wedge \neg \text{XORN}[f][g][10] \wedge \neg \text{XORN}[f][g][11] \wedge \\
& \neg \text{XORN}[f][g][12] \wedge \neg \text{XORN}[f][g][13] \wedge \neg \text{XORN}[f][g][14] \wedge \\
& \neg \text{XORN}[f][g][15] \wedge \neg \text{XORN}[f][g][16] \wedge \neg \text{XORN}[f][g][17] \wedge \\
& \neg \text{XORN}[f][g][18] \wedge \neg \text{XORN}[f][g][19] \wedge \neg \text{XORN}[f][g][20] \wedge \\
& \neg \text{XORN}[f][g][21] \wedge \neg \text{XORN}[f][g][22] \wedge \neg \text{XORN}[f][g][23] \wedge \\
& \neg \text{XORN}[f][g][24] \wedge \neg \text{XORN}[f][g][25] \wedge \neg \text{XORN}[f][g][26] \wedge \\
& \neg \text{XORN}[f][g][27] \wedge \neg \text{XORN}[f][g][28] \wedge \neg \text{XORN}[f][g][29] \wedge \\
& \neg \text{XORN}[f][g][30] \wedge \neg \text{XORN}[f][g][31]) \\
& \text{BY NOT_XORN_EQ} \\
\langle 2 \rangle 7 \quad & \text{CMP32}[f][g] \\
& \text{BY } \langle 1 \rangle 3, \langle 2 \rangle 5, \langle 2 \rangle 6 \text{ DEF CMP32} \\
\langle 2 \rangle 8 \quad & \text{QED BY } \langle 2 \rangle 7 \\
\langle 1 \rangle \quad & \text{QED BY } \langle 1 \rangle 2, \langle 1 \rangle 3
\end{aligned}$$

THEOREM $CMP64_F_EQ_G \triangleq$

ASSUME $N = 63$ PROVE

$\forall f, g \in BVN :$

$CMP64[f][g] \equiv f = g$

PROOF

$\langle 1 \rangle 1$ TAKE $f, g \in BVN$

$\langle 1 \rangle 2$ ASSUME $CMP64[f][g]$ PROVE $f = g$

$\langle 2 \rangle 1$

$(\neg XORN[f][g][0] \wedge \neg XORN[f][g][1] \wedge \neg XORN[f][g][2] \wedge$
 $\neg XORN[f][g][3] \wedge \neg XORN[f][g][4] \wedge \neg XORN[f][g][5] \wedge$
 $\neg XORN[f][g][6] \wedge \neg XORN[f][g][7] \wedge \neg XORN[f][g][8] \wedge$
 $\neg XORN[f][g][9] \wedge \neg XORN[f][g][10] \wedge \neg XORN[f][g][11] \wedge$
 $\neg XORN[f][g][12] \wedge \neg XORN[f][g][13] \wedge \neg XORN[f][g][14] \wedge$
 $\neg XORN[f][g][15] \wedge \neg XORN[f][g][16] \wedge \neg XORN[f][g][17] \wedge$
 $\neg XORN[f][g][18] \wedge \neg XORN[f][g][19] \wedge \neg XORN[f][g][20] \wedge$
 $\neg XORN[f][g][21] \wedge \neg XORN[f][g][22] \wedge \neg XORN[f][g][23] \wedge$
 $\neg XORN[f][g][24] \wedge \neg XORN[f][g][25] \wedge \neg XORN[f][g][26] \wedge$
 $\neg XORN[f][g][27] \wedge \neg XORN[f][g][28] \wedge \neg XORN[f][g][29] \wedge$
 $\neg XORN[f][g][30] \wedge \neg XORN[f][g][31] \wedge$
 $\neg XORN[f][g][32] \wedge \neg XORN[f][g][33] \wedge \neg XORN[f][g][34] \wedge$
 $\neg XORN[f][g][35] \wedge \neg XORN[f][g][36] \wedge \neg XORN[f][g][37] \wedge$
 $\neg XORN[f][g][38] \wedge \neg XORN[f][g][39] \wedge \neg XORN[f][g][40] \wedge$
 $\neg XORN[f][g][41] \wedge \neg XORN[f][g][42] \wedge \neg XORN[f][g][43] \wedge$
 $\neg XORN[f][g][44] \wedge \neg XORN[f][g][45] \wedge \neg XORN[f][g][46] \wedge$
 $\neg XORN[f][g][47] \wedge \neg XORN[f][g][48] \wedge \neg XORN[f][g][49] \wedge$
 $\neg XORN[f][g][50] \wedge \neg XORN[f][g][51] \wedge \neg XORN[f][g][52] \wedge$
 $\neg XORN[f][g][53] \wedge \neg XORN[f][g][54] \wedge \neg XORN[f][g][55] \wedge$
 $\neg XORN[f][g][56] \wedge \neg XORN[f][g][57] \wedge \neg XORN[f][g][58] \wedge$
 $\neg XORN[f][g][59] \wedge \neg XORN[f][g][60] \wedge \neg XORN[f][g][61] \wedge$
 $\neg XORN[f][g][62] \wedge \neg XORN[f][g][63]) \Rightarrow$

$(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$
 $f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge$
 $f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge$
 $f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge$
 $f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge$
 $f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge$
 $f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge$
 $f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31] \wedge$
 $f[32] = g[32] \wedge f[33] = g[33] \wedge f[34] = g[34] \wedge f[35] = g[35] \wedge$
 $f[36] = g[36] \wedge f[37] = g[37] \wedge f[38] = g[38] \wedge f[39] = g[39] \wedge$
 $f[40] = g[40] \wedge f[41] = g[41] \wedge f[42] = g[42] \wedge f[43] = g[43] \wedge$
 $f[44] = g[44] \wedge f[45] = g[45] \wedge f[46] = g[46] \wedge f[47] = g[47] \wedge$
 $f[48] = g[48] \wedge f[49] = g[49] \wedge f[50] = g[50] \wedge f[51] = g[51] \wedge$
 $f[52] = g[52] \wedge f[53] = g[53] \wedge f[54] = g[54] \wedge f[55] = g[55] \wedge$
 $f[56] = g[56] \wedge f[57] = g[57] \wedge f[58] = g[58] \wedge f[59] = g[59] \wedge$

$f[60] = g[60] \wedge f[61] = g[61] \wedge f[62] = g[62] \wedge f[63] = g[63]$
 BY *NOT_XORN_EQ*
 $\langle 2 \rangle 2$
 $(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$
 $f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge$
 $f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge$
 $f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge$
 $f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge$
 $f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge$
 $f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge$
 $f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31] \wedge$
 $f[32] = g[32] \wedge f[33] = g[33] \wedge f[34] = g[34] \wedge f[35] = g[35] \wedge$
 $f[36] = g[36] \wedge f[37] = g[37] \wedge f[38] = g[38] \wedge f[39] = g[39] \wedge$
 $f[40] = g[40] \wedge f[41] = g[41] \wedge f[42] = g[42] \wedge f[43] = g[43] \wedge$
 $f[44] = g[44] \wedge f[45] = g[45] \wedge f[46] = g[46] \wedge f[47] = g[47] \wedge$
 $f[48] = g[48] \wedge f[49] = g[49] \wedge f[50] = g[50] \wedge f[51] = g[51] \wedge$
 $f[52] = g[52] \wedge f[53] = g[53] \wedge f[54] = g[54] \wedge f[55] = g[55] \wedge$
 $f[56] = g[56] \wedge f[57] = g[57] \wedge f[58] = g[58] \wedge f[59] = g[59] \wedge$
 $f[60] = g[60] \wedge f[61] = g[61] \wedge f[62] = g[62] \wedge f[63] = g[63]) \Rightarrow$
 $(f = g)$
 BY DEF *BVN*
 $\langle 2 \rangle 3 f = g$
 BY $\langle 1 \rangle 2, \langle 2 \rangle 1, \langle 2 \rangle 2$ DEF *CMP64*
 $\langle 2 \rangle 4$ QED BY $\langle 2 \rangle 3$
 $\langle 1 \rangle 3$ ASSUME $f = g$ PROVE *CMP64*[f][g]
 $\langle 2 \rangle 5 (f = g) \Rightarrow$
 $(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$
 $f[4] = g[4] \wedge f[5] = g[5] \wedge f[6] = g[6] \wedge f[7] = g[7] \wedge$
 $f[8] = g[8] \wedge f[9] = g[9] \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge$
 $f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge$
 $f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge$
 $f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge$
 $f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge$
 $f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31] \wedge$
 $f[32] = g[32] \wedge f[33] = g[33] \wedge f[34] = g[34] \wedge f[35] = g[35] \wedge$
 $f[36] = g[36] \wedge f[37] = g[37] \wedge f[38] = g[38] \wedge f[39] = g[39] \wedge$
 $f[40] = g[40] \wedge f[41] = g[41] \wedge f[42] = g[42] \wedge f[43] = g[43] \wedge$
 $f[44] = g[44] \wedge f[45] = g[45] \wedge f[46] = g[46] \wedge f[47] = g[47] \wedge$
 $f[48] = g[48] \wedge f[49] = g[49] \wedge f[50] = g[50] \wedge f[51] = g[51] \wedge$
 $f[52] = g[52] \wedge f[53] = g[53] \wedge f[54] = g[54] \wedge f[55] = g[55] \wedge$
 $f[56] = g[56] \wedge f[57] = g[57] \wedge f[58] = g[58] \wedge f[59] = g[59] \wedge$
 $f[60] = g[60] \wedge f[61] = g[61] \wedge f[62] = g[62] \wedge f[63] = g[63])$
 OBVIOUS
 $\langle 2 \rangle 6$
 $(f[0] = g[0] \wedge f[1] = g[1] \wedge f[2] = g[2] \wedge f[3] = g[3] \wedge$

$$\begin{aligned}
& f[4] = g[4] \quad \wedge f[5] = g[5] \quad \wedge f[6] = g[6] \quad \wedge f[7] = g[7] \quad \wedge \\
& f[8] = g[8] \quad \wedge f[9] = g[9] \quad \wedge f[10] = g[10] \wedge f[11] = g[11] \wedge \\
& f[12] = g[12] \wedge f[13] = g[13] \wedge f[14] = g[14] \wedge f[15] = g[15] \wedge \\
& f[16] = g[16] \wedge f[17] = g[17] \wedge f[18] = g[18] \wedge f[19] = g[19] \wedge \\
& f[20] = g[20] \wedge f[21] = g[21] \wedge f[22] = g[22] \wedge f[23] = g[23] \wedge \\
& f[24] = g[24] \wedge f[25] = g[25] \wedge f[26] = g[26] \wedge f[27] = g[27] \wedge \\
& f[28] = g[28] \wedge f[29] = g[29] \wedge f[30] = g[30] \wedge f[31] = g[31] \wedge \\
& f[32] = g[32] \wedge f[33] = g[33] \wedge f[34] = g[34] \wedge f[35] = g[35] \wedge \\
& f[36] = g[36] \wedge f[37] = g[37] \wedge f[38] = g[38] \wedge f[39] = g[39] \wedge \\
& f[40] = g[40] \wedge f[41] = g[41] \wedge f[42] = g[42] \wedge f[43] = g[43] \wedge \\
& f[44] = g[44] \wedge f[45] = g[45] \wedge f[46] = g[46] \wedge f[47] = g[47] \wedge \\
& f[48] = g[48] \wedge f[49] = g[49] \wedge f[50] = g[50] \wedge f[51] = g[51] \wedge \\
& f[52] = g[52] \wedge f[53] = g[53] \wedge f[54] = g[54] \wedge f[55] = g[55] \wedge \\
& f[56] = g[56] \wedge f[57] = g[57] \wedge f[58] = g[58] \wedge f[59] = g[59] \wedge \\
& f[60] = g[60] \wedge f[61] = g[61] \wedge f[62] = g[62] \wedge f[63] = g[63] \Rightarrow \\
& (\neg XORN[f][g][0] \wedge \neg XORN[f][g][1] \wedge \neg XORN[f][g][2] \wedge \\
& \neg XORN[f][g][3] \wedge \neg XORN[f][g][4] \wedge \neg XORN[f][g][5] \wedge \\
& \neg XORN[f][g][6] \wedge \neg XORN[f][g][7] \wedge \neg XORN[f][g][8] \wedge \\
& \neg XORN[f][g][9] \wedge \neg XORN[f][g][10] \wedge \neg XORN[f][g][11] \wedge \\
& \neg XORN[f][g][12] \wedge \neg XORN[f][g][13] \wedge \neg XORN[f][g][14] \wedge \\
& \neg XORN[f][g][15] \wedge \neg XORN[f][g][16] \wedge \neg XORN[f][g][17] \wedge \\
& \neg XORN[f][g][18] \wedge \neg XORN[f][g][19] \wedge \neg XORN[f][g][20] \wedge \\
& \neg XORN[f][g][21] \wedge \neg XORN[f][g][22] \wedge \neg XORN[f][g][23] \wedge \\
& \neg XORN[f][g][24] \wedge \neg XORN[f][g][25] \wedge \neg XORN[f][g][26] \wedge \\
& \neg XORN[f][g][27] \wedge \neg XORN[f][g][28] \wedge \neg XORN[f][g][29] \wedge \\
& \neg XORN[f][g][30] \wedge \neg XORN[f][g][31] \wedge \\
& \neg XORN[f][g][32] \wedge \neg XORN[f][g][33] \wedge \neg XORN[f][g][34] \wedge \\
& \neg XORN[f][g][35] \wedge \neg XORN[f][g][36] \wedge \neg XORN[f][g][37] \wedge \\
& \neg XORN[f][g][38] \wedge \neg XORN[f][g][39] \wedge \neg XORN[f][g][40] \wedge \\
& \neg XORN[f][g][41] \wedge \neg XORN[f][g][42] \wedge \neg XORN[f][g][43] \wedge \\
& \neg XORN[f][g][44] \wedge \neg XORN[f][g][45] \wedge \neg XORN[f][g][46] \wedge \\
& \neg XORN[f][g][47] \wedge \neg XORN[f][g][48] \wedge \neg XORN[f][g][49] \wedge \\
& \neg XORN[f][g][50] \wedge \neg XORN[f][g][51] \wedge \neg XORN[f][g][52] \wedge \\
& \neg XORN[f][g][53] \wedge \neg XORN[f][g][54] \wedge \neg XORN[f][g][55] \wedge \\
& \neg XORN[f][g][56] \wedge \neg XORN[f][g][57] \wedge \neg XORN[f][g][58] \wedge \\
& \neg XORN[f][g][59] \wedge \neg XORN[f][g][60] \wedge \neg XORN[f][g][61] \wedge \\
& \neg XORN[f][g][62] \wedge \neg XORN[f][g][63]) \\
& \text{BY } NOT_XORN_EQ \\
& \langle 2 \rangle 7 \text{ CMP64}[f][g] \\
& \text{BY } \langle 1 \rangle 3, \langle 2 \rangle 5, \langle 2 \rangle 6 \text{ DEF CMP64} \\
& \langle 2 \rangle 8 \text{ QED BY } \langle 2 \rangle 7 \\
& \langle 1 \rangle \text{ QED BY } \langle 1 \rangle 2, \langle 1 \rangle 3
\end{aligned}$$

\ * Modification History
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\ * Created *Thu Nov 03 00:11:52 CDT 2022* by *mjhomefolder*