HWC axioms

HWC001-0.ax Definitions of AND, OR and NOT
$\text{and}(n_0, n_0) = n_0$ cnf(and_definition$_1$, axiom)
$\text{and}(n_0, n_1) = n_0$ cnf(and_definition$_2$, axiom)
$\text{and}(n_1, n_0) = n_0$ cnf(and_definition$_3$, axiom)
$\text{and}(n_1, n_1) = n_1$ cnf(and_definition$_4$, axiom)
$\text{or}(n_0, n_0) = n_0$ cnf(or_definition$_1$, axiom)
$\text{or}(n_0, n_1) = n_1$ cnf(or_definition$_2$, axiom)
$\text{or}(n_1, n_0) = n_1$ cnf(or_definition$_3$, axiom)
$\text{or}(n_1, n_1) = n_1$ cnf(or_definition$_4$, axiom)
$\text{not}(n_0) = n_1$ cnf(not_definition$_1$, axiom)
$\text{not}(n_1) = n_0$ cnf(not_definition$_2$, axiom)

HWC002-0.ax Definitions of AND, OR and NOT
$\text{and}(x, n_0) = n_0$ cnf(and_definition$_1$, axiom)
$\text{and}(x, n_1) = x$ cnf(and_definition$_2$, axiom)
$\text{or}(x, n_0) = x$ cnf(or_definition$_1$, axiom)
$\text{or}(x, n_1) = n_1$ cnf(or_definition$_2$, axiom)
$\text{not}(n_0) = n_1$ cnf(not_definition$_1$, axiom)
$\text{not}(n_1) = n_0$ cnf(not_definition$_2$, axiom)

HWC problems

HWC001-1.p Design an OR gate using NAND gates
$x \uparrow y = \text{not}(\text{and}(x, y))$ cnf(nand_definition, axiom)
$\text{and}(x, n_0) = n_0$ cnf(and_definition$_1$, axiom)
$\text{and}(x, n_1) = x$ cnf(and_definition$_2$, axiom)
$\text{not}(n_0) = n_1$ cnf(not_definition$_1$, axiom)
$\text{not}(n_1) = n_0$ cnf(not_definition$_2$, axiom)
$(\text{output}(x_1, x_2, x_3, x_4) \text{ and } \text{output}(y_1, y_2, y_3, y_4)) \Rightarrow \text{output}(x_1 \uparrow y_1, x_2 \uparrow y_2, x_3 \uparrow y_3, x_4 \uparrow y_4)$ cnf(nand_table_definition, ne
$\text{output}(n_0, n_0, n_1, n_1)$ cnf(input$_1$, negated_conjecture)
$\text{output}(n_0, n_1, n_0, n_1)$ cnf(input$_2$, negated_conjecture)
$\neg\, \text{output}(n_0, n_1, n_1, n_1)$ cnf(prove_cannot_make_or, negated_conjecture)

HWC003-1.p Invert 3 inputs with 2 not gates
include('Axioms/HWC002-0.ax')
$\text{add\_inverter}(\text{list}(x, y), z) = \text{list}(x, \text{add\_inverter}(y, z))$ cnf(add_inverter_definition$_1$, axiom)
$\text{add\_inverter}(x, y) = \text{list}(y, x)$ cnf(add_inverter_definition$_2$, axiom)
$\text{make\_reverse\_list}(\text{list}(\text{inverter\_table}(x_{000}, x_{001}, x_{010}, x_{011}, x_{100}, x_{101}, x_{110}, x_{111}), v)) = \text{list\_reversion}(\text{possible\_reversion}(\text{r00m}, x_{0}$
$\text{make\_reverse\_list}(v) = \text{end}$ cnf(make_reverse_list_definition$_2$, axiom)
$\text{possible\_reversion}(\text{xname}, n_1, n_0) = \text{xname}$ cnf(possible_reversion$_1$, axiom)
$\text{possible\_reversion}(\text{xname}, n_0, n_1) = \text{not\_reversion}$ cnf(possible_reversion$_2$, axiom)
$\text{possible\_reversion}(\text{xname}, x, x) = \text{not\_reversion}$ cnf(possible_reversion$_3$, axiom)
$\text{list\_reversion}(\text{not\_reversion}, x) = x$ cnf(list_reversion_definition$_1$, axiom)
$\text{list\_reversion}(x, \text{list\_reversion}(y, z)) = \text{list\_reversion}(y, \text{list\_reversion}(x, z))$ cnf(list_reversion_definition$_2$, axiom)
$\text{list\_reversion}(x, \text{list\_reversion}(x, y)) = \text{list\_reversion}(x, y)$ cnf(list_reversion_definition$_3$, axiom)
$(\text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \text{ and } \text{output}(y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8, v)) \Rightarrow \text{output}(\text{and}(x_1, y_1), \text{and}(x_2, y_2), \text{and}(x_3, y_3$
$(\text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \text{ and } \text{output}(y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8, v)) \Rightarrow \text{output}(\text{or}(x_1, y_1), \text{or}(x_2, y_2), \text{or}(x_3, y_3), \text{or}$
$\text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \Rightarrow \text{test}(\text{not}(x_1), \text{not}(x_2), \text{not}(x_3), \text{not}(x_4), \text{not}(x_5), \text{not}(x_6), \text{not}(x_7), \text{not}(x_8), \text{add\_inverte}$
$\text{test}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v, \text{xrevlist}) \Rightarrow \text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v)$ cnf(create_test, axiom)
$\text{output}(n_0, n_0, n_0, n_0, n_1, n_1, n_1, n_1, x)$ cnf(input$_1$, negated_conjecture)
$\text{output}(n_0, n_0, n_1, n_1, n_0, n_0, n_1, n_1, x)$ cnf(input$_2$, negated_conjecture)
$\text{output}(n_0, n_1, n_0, n_1, n_0, n_1, n_0, n_1, x)$ cnf(input$_3$, negated_conjecture)
$(\text{output}(n_1, n_1, n_1, n_1, n_0, n_0, n_0, n_0, v) \text{ and } \text{output}(n_1, n_1, n_0, n_0, n_1, n_1, n_0, n_0, v)) \Rightarrow \neg\, \text{output}(n_1, n_0, n_1, n_0, n_1, n_0, n_1, n_0, v$

HWC003-2.p Invert 3 inputs with 2 not gates
include('Axioms/HWC002-0.ax')
$\text{add\_inverter}(\text{list}(x, y), z) = \text{list}(x, \text{add\_inverter}(y, z))$ cnf(add_inverter_definition$_1$, axiom)
$\text{add\_inverter}(x, y) = \text{list}(y, x)$ cnf(add_inverter_definition$_2$, axiom)
$\text{make\_reverse\_list}(\text{list}(\text{inverter\_table}(x_{000}, x_{001}, x_{010}, x_{011}, x_{100}, x_{101}, x_{110}, x_{111}), v)) = \text{list\_reversion}(\text{possible\_reversion}(\text{r00m}, x_{0}$

$\text{make\_reverse\_list}(v) = \text{end}$ $\text{cnf}(\text{make\_reverse\_list\_definition}_2, \text{axiom})$
$\text{possible\_reversion}(\text{xname}, n_1, n_0) = \text{xname}$ $\text{cnf}(\text{possible\_reversion}_1, \text{axiom})$
$\text{possible\_reversion}(\text{xname}, n_0, n_1) = \text{not\_reversion}$ $\text{cnf}(\text{possible\_reversion}_2, \text{axiom})$
$\text{possible\_reversion}(\text{xname}, x, x) = \text{not\_reversion}$ $\text{cnf}(\text{possible\_reversion}_3, \text{axiom})$
$\text{list\_reversion}(\text{not\_reversion}, x) = x$ $\text{cnf}(\text{list\_reversion\_definition}_1, \text{axiom})$
$\text{list\_reversion}(x, \text{list\_reversion}(y, z)) = \text{list\_reversion}(y, \text{list\_reversion}(x, z))$ $\text{cnf}(\text{list\_reversion\_definition}_2, \text{axiom})$
$\text{list\_reversion}(x, \text{list\_reversion}(x, y)) = \text{list\_reversion}(x, y)$ $\text{cnf}(\text{list\_reversion\_definition}_3, \text{axiom})$
$(\text{basic\_output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \text{ and } \text{basic\_output}(y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8, v)) \Rightarrow \text{basic\_output}(\text{and}(x_1, y_1), \text{and}($
$(\text{basic\_output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \text{ and } \text{output}(y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8, v)) \Rightarrow \text{output}(\text{or}(x_1, y_1), \text{or}(x_2, y_2), \text{or}(x_3, y$
$\text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \Rightarrow \text{test}(\text{not}(x_1), \text{not}(x_2), \text{not}(x_3), \text{not}(x_4), \text{not}(x_5), \text{not}(x_6), \text{not}(x_7), \text{not}(x_8), \text{add\_inverte}$
$\text{basic\_output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v) \Rightarrow \text{output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v)$ $\text{cnf}(\text{basic\_output\_definition}, \text{axiom})$
$\text{test}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v, \text{xrevlist}) \Rightarrow \text{basic\_output}(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, v)$ $\text{cnf}(\text{create\_test}, \text{axiom})$
$\text{output}(n_0, n_0, n_0, n_0, n_1, n_1, n_1, n_1, x)$ $\text{cnf}(\text{input}_1, \text{negated\_conjecture})$
$\text{output}(n_0, n_0, n_1, n_1, n_0, n_0, n_1, n_1, x)$ $\text{cnf}(\text{input}_2, \text{negated\_conjecture})$
$\text{output}(n_0, n_1, n_0, n_1, n_0, n_1, n_0, n_1, x)$ $\text{cnf}(\text{input}_3, \text{negated\_conjecture})$
$(\text{output}(n_1, n_1, n_1, n_1, n_0, n_0, n_0, n_0, v) \text{ and } \text{output}(n_1, n_1, n_0, n_0, n_1, n_1, n_0, n_0, v)) \Rightarrow \neg\, \text{output}(n_1, n_0, n_1, n_0, n_1, n_0, n_1, n_0, v)$

HWC004-1.p Definitions of AND, OR and NOT
include('Axioms/HWC001-0.ax')

HWC004-2.p Definitions of AND, OR and NOT
include('Axioms/HWC002-0.ax')