

a

$$\{(y = y_5), A_1, (y_5 = y_3), \neg(y_5 = y_4), (x_1 \geq 1), (y_3 = y_1), \\ \neg(y_3 = y_2), (x_2 \geq 1), (y_1 = f_{11}), \neg(y_1 = f_{12})\}$$

$$\begin{array}{ll} (\neg A_1 \vee \neg(x_1 \geq 1) \vee \neg(x_2 \geq 1) \vee (y_1 = f_{11})) & A(\neg A_1 \vee \neg A_2 \vee (y_1 = f_{11})) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee (x_2 \geq 1) \vee (y_1 = f_{12})) & A(\neg A_1 \vee \neg A_2 \vee (y_1 = f_{12})) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee \neg(y_1 = f_{11}) \vee \neg(y_1 = f_{12})) & A(\neg A_1 \vee \neg(y_1 = f_{11}) \vee \neg(y_1 = f_{12})) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee \neg(x_2 \geq 2) \vee (y_2 = f_{21})) & A(\neg A_1 \vee (y_5 = y_3)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee (x_2 \geq 2) \vee (y_2 = f_{22})) & A(\neg A_1 \vee (y_5 = y_4)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee \neg(y_2 = f_{21}) \vee \neg(y_2 = f_{22})) & A(\neg(y_5 = y_3) \vee \neg(y_5 = y_4)) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee (y_3 = y_1)) & A((y = y_5)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee (y_3 = y_2)) & \\ A(\neg A_1 \vee \neg(y_3 = y_1) \vee \neg(y_3 = y_2)) & \end{array}$$

b

$$\{(y = y_5), A_1, (y_5 = y_3), \neg(y_5 = y_4), (x_1 \geq 1), (y_3 = y_1), \\ \neg(y_3 = y_2), \neg(x_2 \geq 1), (y_1 = f_{12}), \neg(y_1 = f_{11})\}$$

$$\begin{array}{ll} (\neg A_1 \vee \neg(x_1 \geq 1) \vee \neg(x_2 \geq 1) \vee (y_1 = f_{11})) & A(\neg A_1 \vee \neg A_2 \vee (y_1 = f_{11})) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee (x_2 \geq 1) \vee (y_1 = f_{12})) & A(\neg A_1 \vee \neg A_2 \vee (y_1 = f_{12})) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee \neg(y_1 = f_{11}) \vee \neg(y_1 = f_{12})) & A(\neg A_1 \vee \neg(y_1 = f_{11}) \vee \neg(y_1 = f_{12})) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee \neg(x_2 \geq 2) \vee (y_2 = f_{21})) & A(\neg A_1 \vee (y_5 = y_3)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee (x_2 \geq 2) \vee (y_2 = f_{22})) & A(\neg A_1 \vee (y_5 = y_4)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee \neg(y_2 = f_{21}) \vee \neg(y_2 = f_{22})) & A(\neg(y_5 = y_3) \vee \neg(y_5 = y_4)) \\ A(\neg A_1 \vee \neg(x_1 \geq 1) \vee (y_3 = y_1)) & A((y = y_5)) \\ A(\neg A_1 \vee (x_1 \geq 1) \vee (y_3 = y_2)) & A(\neg A_1 \vee \neg(x_1 \geq 1) \vee \neg(x_2 \geq 1)) \\ A(\neg A_1 \vee \neg(y_3 = y_1) \vee \neg(y_3 = y_2)) & \end{array}$$

c

$$TA(\exists xy. (\varphi \wedge \chi \wedge [y = w]_{cur}))$$

Assignment	Labeling
$\chi \cup \{ \neg A_1, (x_1 \geq 1), (x_2 \geq 1) \}$	$y = y_5 = y_3 = y_1 = f_{11}$
$\chi \cup \{ \neg A_1, (x_1 \geq 1), \neg(x_2 \geq 1) \}$	$y = y_5 = y_3 = y_1 = f_{12}$
$\chi \cup \{ \neg A_1, \neg(x_1 \geq 1), (x_2 \geq 2) \}$	$y = y_5 = y_3 = y_2 = f_{21}$
$\chi \cup \{ \neg A_1, \neg(x_1 \geq 1), \neg(x_2 \geq 2) \}$	$y = y_5 = y_3 = y_2 = f_{22}$
$\chi \cup \{ \neg A_1, A_2 \}$	$y = y_5 = y_4 = f_{11}$
$\chi \cup \{ \neg A_1, \neg A_2 \}$	$y = y_5 = y_4 = f_{12}$