Outline

Exercise 9. Problem 1

Let x be a variable with the domain $\{u, v, w\}$ and p be a boolean variable. Transform the following formula of PLFD into a propositional formula: $\neg x = v \rightarrow x = u \wedge p = 0$.

$$\begin{array}{l}(x_u \vee x_v \vee x_w) \wedge \\ (\neg x_u \vee \neg x_v) \wedge (\neg x_u \vee \neg x_w) \wedge (\neg x_v \vee \neg x_w) \wedge \\ (\neg x_v \rightarrow x_u \wedge \neg p)\end{array}.$$

Common Mistakes:

1. The domain axiom is missing.
2. Only the domain axiom is given.
3. Some still have problems with parentheses.

Exercise 9. Problem 1

Let x be a variable with the domain $\{u, v, w\}$ and p be a boolean variable. Transform the following formula of PLFD into a propositional formula: $\neg x = v \rightarrow x = u \land p = 0$.

$$
\begin{array}{l}
(x_u \lor x_v \lor x_w) \land \\
(\neg x_u \lor \neg x_v) \land (\neg x_u \lor \neg x_w) \land (\neg x_v \lor \neg x_w) \land \\
(\neg x_v \rightarrow x_u \land \neg p)
\end{array} .
$$

Common Mistakes:

1. The domain axiom is missing.
2. Only the domain axiom is given.
3. Some still have problems with parentheses.

Exercise 9. Problem 1

Let x be a variable with the domain $\{u, v, w\}$ and p be a boolean variable. Transform the following formula of PLFD into a propositional formula: $\neg x = v \rightarrow x = u \wedge p = 0$.

$$
\begin{array}{l}
(x_u \vee x_v \vee x_w) \wedge \\
(\neg x_u \vee \neg x_v) \wedge (\neg x_u \vee \neg x_w) \wedge (\neg x_v \vee \neg x_w) \wedge \\
(\neg x_v \rightarrow x_u \wedge \neg p)
\end{array}
.
$$

Common Mistakes:

1. The domain axiom is missing.
2. Only the domain axiom is given.
3. Some still have problems with parentheses.

Exercise 9. Problem 2

We know that students only drink beer while professors only drink coffee. Represent the set of states in which there is a drink in the dispenser but it does not suit the current customer.

$$(\text{disp} = \textit{beer} \wedge \text{customer} = \textit{prof}) \vee$$
$$(\text{disp} = \textit{coffee} \wedge \text{customer} = \textit{student}).$$

Common Mistakes:

1. Mixing the drink storage with the dispenser.
2. Variables other than disp and customer are included in the formula.
3. Conjunction is used instead of disjunction or vice versa.
4. More than one formula is given.

Exercise 9. Problem 2

We know that students only drink beer while professors only drink coffee. Represent the set of states in which there is a drink in the dispenser but it does not suit the current customer.

$$(\text{disp} = \textit{beer} \wedge \text{customer} = \textit{prof}) \vee$$
$$(\text{disp} = \textit{coffee} \wedge \text{customer} = \textit{student}).$$

Common Mistakes:

1. Mixing the drink storage with the dispenser.
2. Variables other than disp and customer are included in the formula.
3. Conjunction is used instead of disjunction or vice versa.
4. More than one formula is given.

Exercise 9. Problem 2

We know that students only drink beer while professors only drink coffee. Represent the set of states in which there is a drink in the dispenser but it does not suit the current customer.

$$(\text{disp} = \textit{beer} \wedge \text{customer} = \textit{prof}) \vee \\ (\text{disp} = \textit{coffee} \wedge \text{customer} = \textit{student}).$$

Common Mistakes:

1. Mixing the drink storage with the dispenser.
2. Variables other than disp and customer are included in the formula.
3. Conjunction is used instead of disjunction or vice versa.
4. More than one formula is given.

Exercise 9. Problem 3

Represent symbolically the money-swallowing transition: this transition can remove any amount of coins from the coin slot.

$$((\text{coins} = 3 \wedge \text{coins}' \neq 3) \vee$$
$$(\text{coins} = 2 \wedge (\text{coins}' = 1 \vee \text{coins}' = 0)) \vee$$
$$(\text{coins} = 1 \wedge \text{coins}' = 0)) \wedge$$
$$\mathit{only}(\mathit{coins}).$$

Common Mistakes:

1. Many assumed that the transition removes all the coins at once.
2. $\mathit{only}(()\mathit{coins})$ is missing.
3. In some answers variables other than coins are included in the formula.
4. Instead of a disjunction $\text{coins}' = 1 \vee \text{coins}' = 2$ an expression $\text{coins}' = 1, 2$ is used.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 3

Represent symbolically the money-swallowing transition: this transition can remove any amount of coins from the coin slot.

$$((\mathrm{coins} = 3 \wedge \mathrm{coins}' \neq 3) \vee$$
$$(\mathrm{coins} = 2 \wedge (\mathrm{coins}' = 1 \vee \mathrm{coins}' = 0)) \vee$$
$$(\mathrm{coins} = 1 \wedge \mathrm{coins}' = 0)) \wedge$$
$$only(coins).$$

Common Mistakes:

1. Many assumed that the transition removes all the coins at once.
2. $only(()coins)$ is missing.
3. In some answers variables other than coins are included in the formula.
4. Instead of a disjunction $\mathrm{coins}' = 1 \vee \mathrm{coins}' = 2$ an expression $\mathrm{coins}' = 1, 2$ is used.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 3

Represent symbolically the money-swallowing transition: this transition can remove any amount of coins from the coin slot.

$$
\begin{aligned}
&((\text{coins} = 3 \wedge \text{coins}' \neq 3) \vee \\
&(\text{coins} = 2 \wedge (\text{coins}' = 1 \vee \text{coins}' = 0)) \vee \\
&(\text{coins} = 1 \wedge \text{coins}' = 0)) \wedge \\
&\mathit{only}(\mathit{coins}).
\end{aligned}
$$

Common Mistakes:

1. Many assumed that the transition removes all the coins at once.
2. $\mathit{only}(()\mathit{coins})$ is missing.
3. In some answers variables other than coins are included in the formula.
4. Instead of a disjunction $\text{coins}' = 1 \vee \text{coins}' = 2$ an expression $\text{coins}' = 1, 2$ is used.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 4

The variable x range over the domain $\{1, 2, 3\}$. Represent the transition which strictly increases the value of x.

$$(x = 1 \land (x' = 2 \lor x' = 3)) \lor$$
$$(x = 2 \land x' = 3).$$

Any equivalent formula is OK, the shortest I could find is

$$(x = 1 \lor x' = 3) \land x \neq x'.$$

Common Mistakes:

1. Sometimes the domain contains 0 as well.
2. The condition $x \neq 3$ is missing
3. Increase by more than one is not considered.
4. Again, expressions like $x' = 1, 2$ are used as formulas.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 4

The variable x range over the domain $\{1, 2, 3\}$. Represent the transition which strictly increases the value of x.

$$(x = 1 \wedge (x' = 2 \vee x' = 3)) \vee$$
$$(x = 2 \wedge x' = 3).$$

Any equivalent formula is OK, the shortest I could find is

$$(x = 1 \vee x' = 3) \wedge x \neq x'.$$

Common Mistakes:

1. Sometimes the domain contains 0 as well.
2. The condition $x \neq 3$ is missing
3. Increase by more than one is not considered.
4. Again, expressions like $x' = 1, 2$ are used as formulas.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 4

The variable x range over the domain $\{1, 2, 3\}$. Represent the transition which strictly increases the value of x.

$$(x = 1 \wedge (x' = 2 \vee x' = 3)) \vee$$
$$(x = 2 \wedge x' = 3).$$

Any equivalent formula is OK, the shortest I could find is

$$(x = 1 \vee x' = 3) \wedge x \neq x'.$$

Common Mistakes:

1. Sometimes the domain contains 0 as well.
2. The condition $x \neq 3$ is missing
3. Increase by more than one is not considered.
4. Again, expressions like $x' = 1, 2$ are used as formulas.
5. A state transition graph is shown as the answer.

Exercise 9. Problem 4

The variable x range over the domain $\{1, 2, 3\}$. Represent the transition which strictly increases the value of x.

$$(x = 1 \wedge (x' = 2 \vee x' = 3)) \vee$$
$$(x = 2 \wedge x' = 3).$$

Any equivalent formula is OK, the shortest I could find is

$$(x = 1 \vee x' = 3) \wedge x \neq x'.$$

Common Mistakes:

1. Sometimes the domain contains 0 as well.
2. The condition $x \neq 3$ is missing
3. Increase by more than one is not considered.
4. Again, expressions like $x' = 1, 2$ are used as formulas.
5. A state transition graph is shown as the answer.