Safe Evolution Templates for Software Product Lines - Catalogue

Software Productivity Group

October 15, 2015

1 Templates for Compositional Product Lines
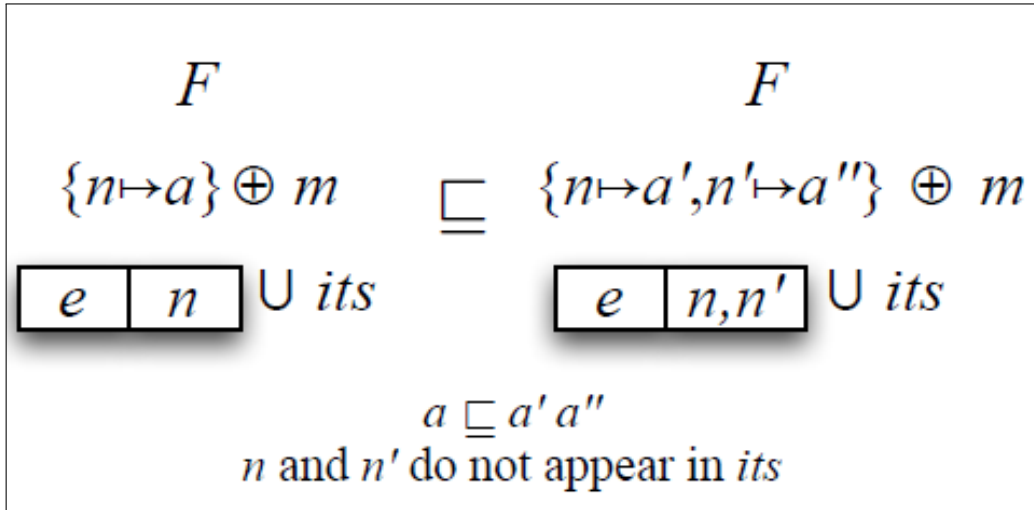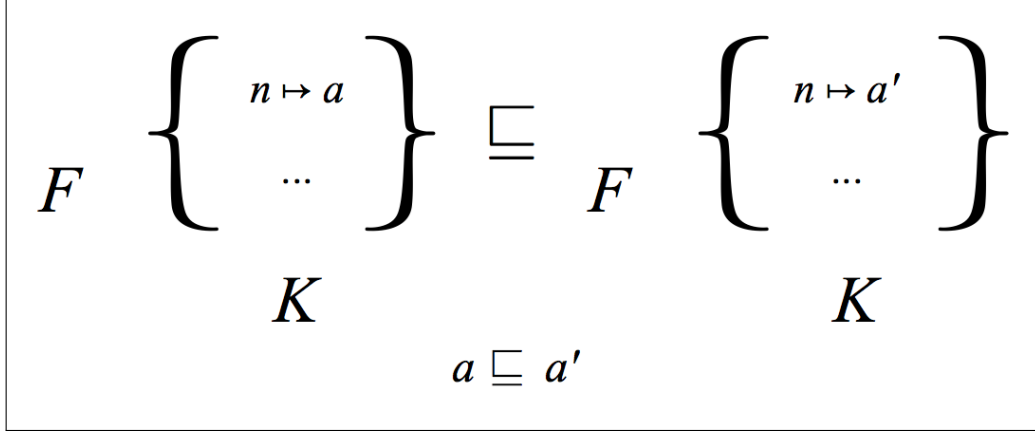

Figure 1: Split Asset (Taken from [**?**])

$$F \left\{ \begin{array}{c} n \mapsto a \\ ... \end{array} \right\}_K \sqsubseteq F \left\{ \begin{array}{c} n \mapsto a' \\ ... \end{array} \right\}_K$$

$$a \sqsubseteq a'$$

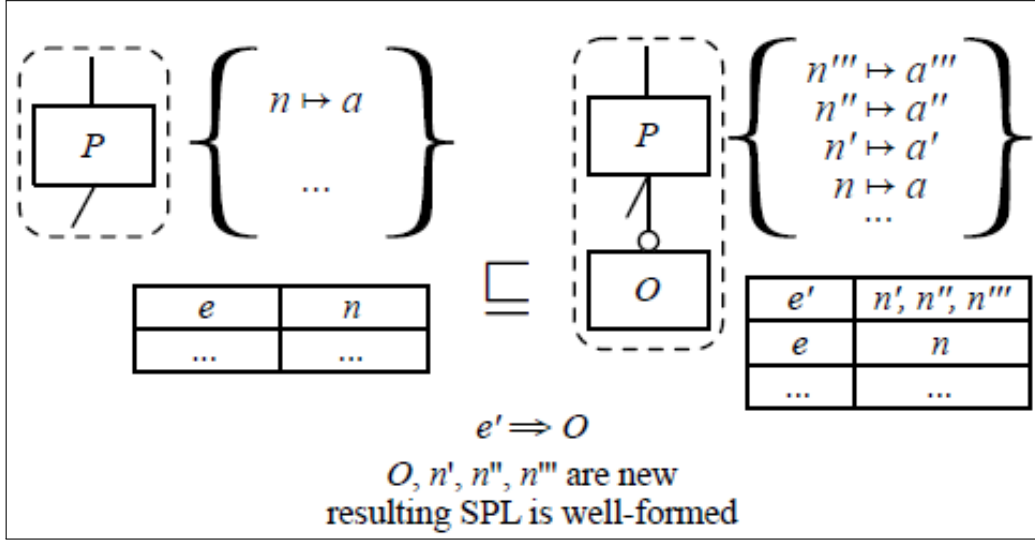Figure 2: Refine Asset (Taken from [**?**])
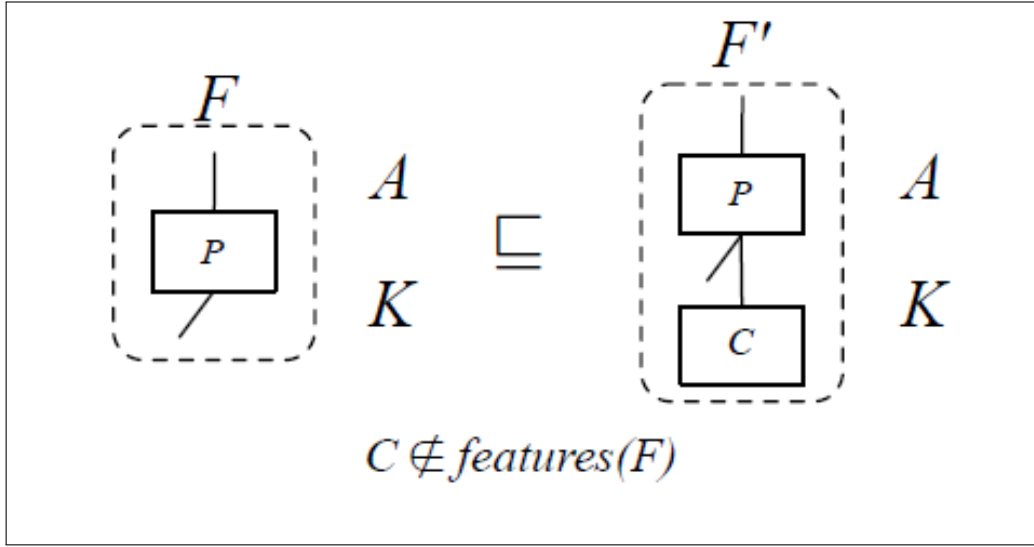

Figure 3: Add New Optional Feature (Taken from [**?**])

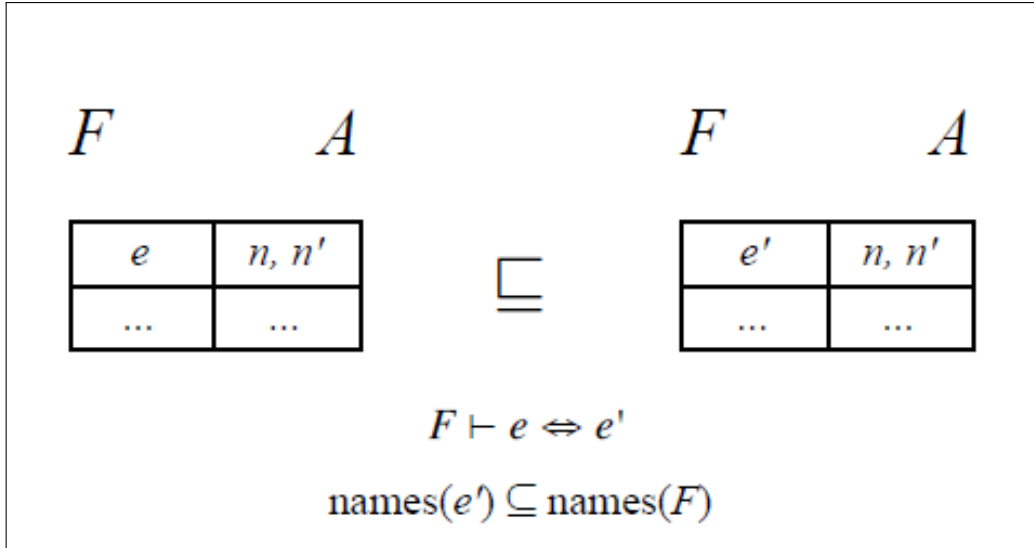Figure 4: Add any feature without changing the AM and CK (Taken from [?])
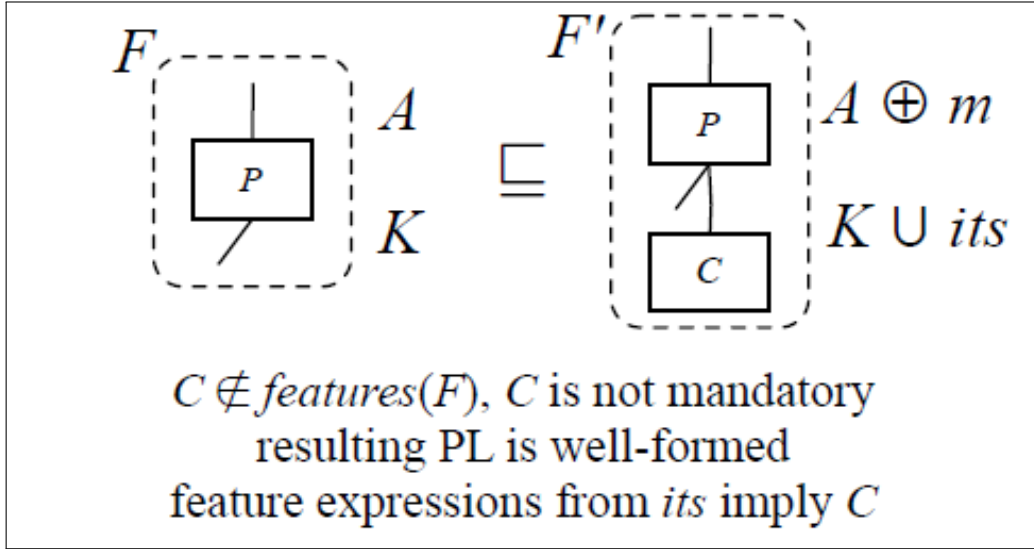

Figure 5: Replace Feature Expression (Taken from [?])

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F F' $A \oplus m$

$$\sqsubseteq$$

$$A$$

$$K$$ $$K \cup its$$

$C \notin features(F)$, C is not mandatory
resulting PL is well-formed
feature expressions from *its* imply C

Figure 6: Add variable feature with implementation (Taken from [?])

$$F \qquad\qquad F$$
$$A' \oplus m \qquad \sqsubseteq \qquad A'$$
$$K \qquad\qquad K$$

$$\forall\, n \in dom(m) \bullet n \text{ does not appear in } K$$
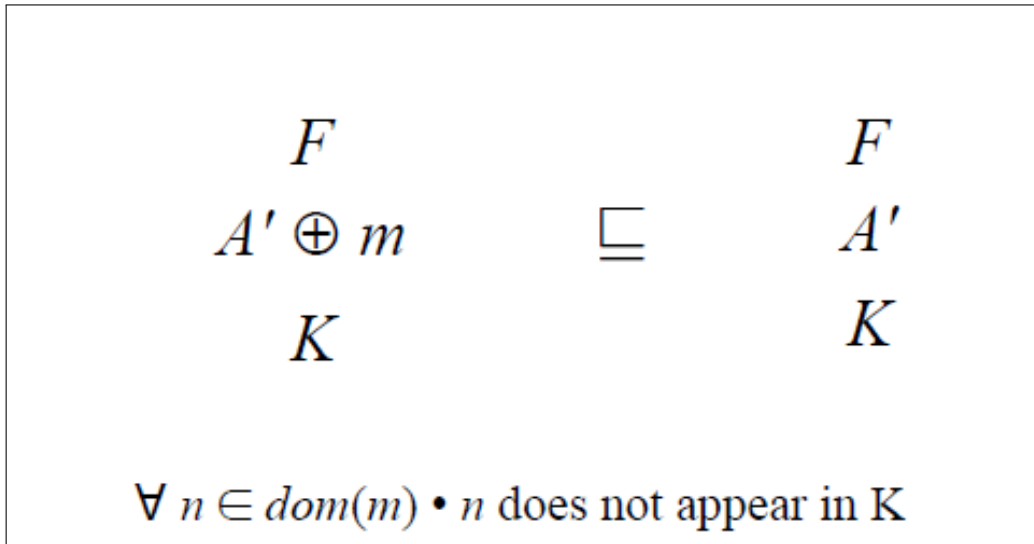
Figure 7: Remove Unused Assets (Taken from [?])

$$F$$
$$A \qquad \sqsubseteq \qquad A \oplus m$$
$$K \qquad\qquad\qquad K$$

$$\forall\, n \in dom(m) \bullet n \text{ does not appear in K}$$

Figure 8: Add Unused Assets (Taken from [?])

$$F \qquad\qquad\qquad\qquad F$$
$$\{n \mapsto a', n' \mapsto a''\} \oplus m \quad \sqsubseteq \quad \{n \mapsto a\} \oplus m$$

$$\boxed{e \mid n, n'} \cup its \qquad\qquad \boxed{e \mid n} \cup its$$

$$a'\,a'' \sqsubseteq a$$
$$n \text{ and } n' \text{ do not appear in } its$$
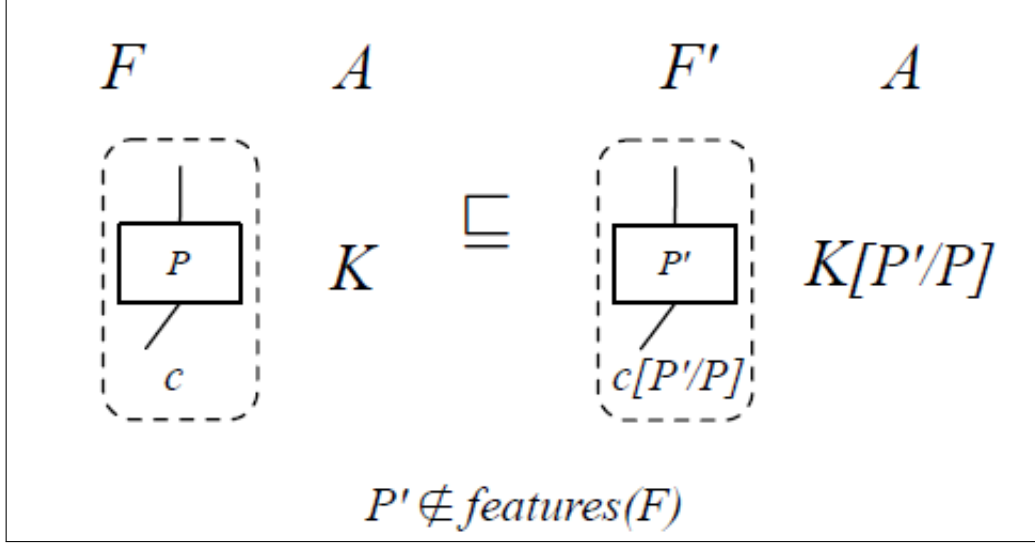
Figure 9: Merge Assets (Taken from [?])

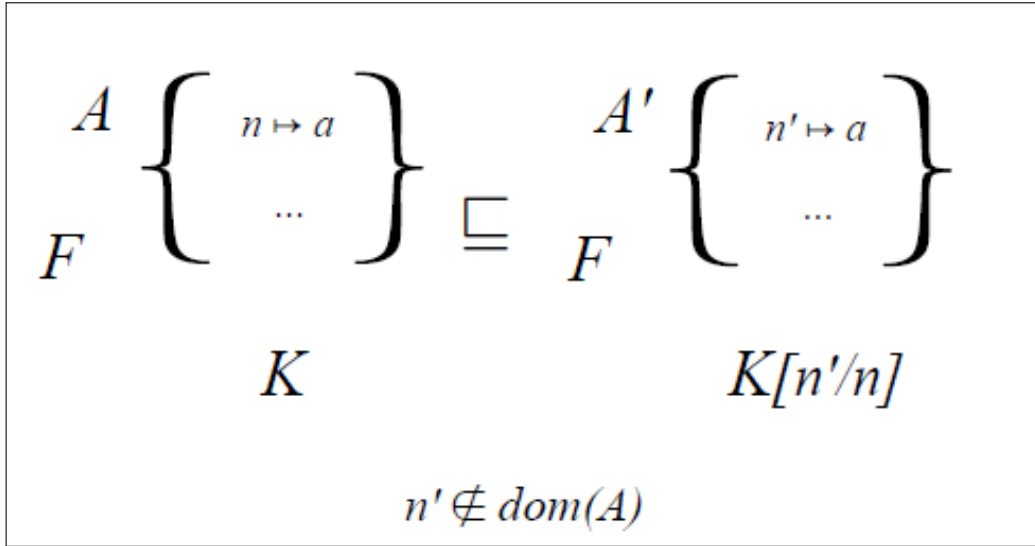Figure 10: Feature Renaming (Taken from [**?**])
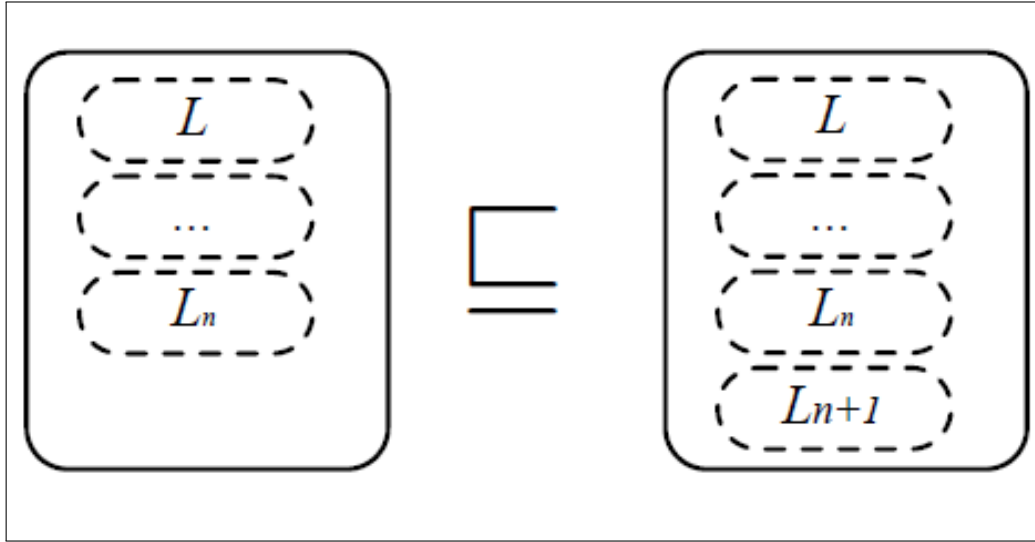

Figure 11: Asset Name Renaming (Taken from [**?**])
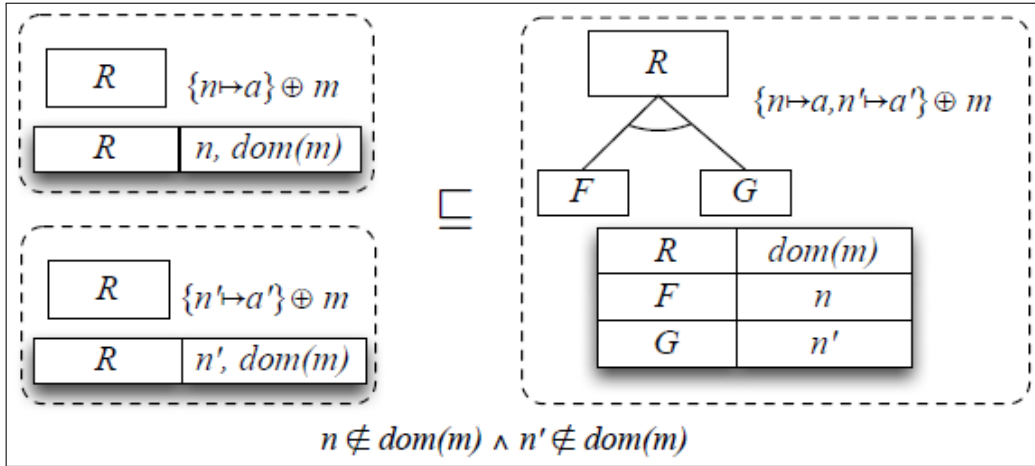
Figure 12: Add Product Line (Taken from [**?**])

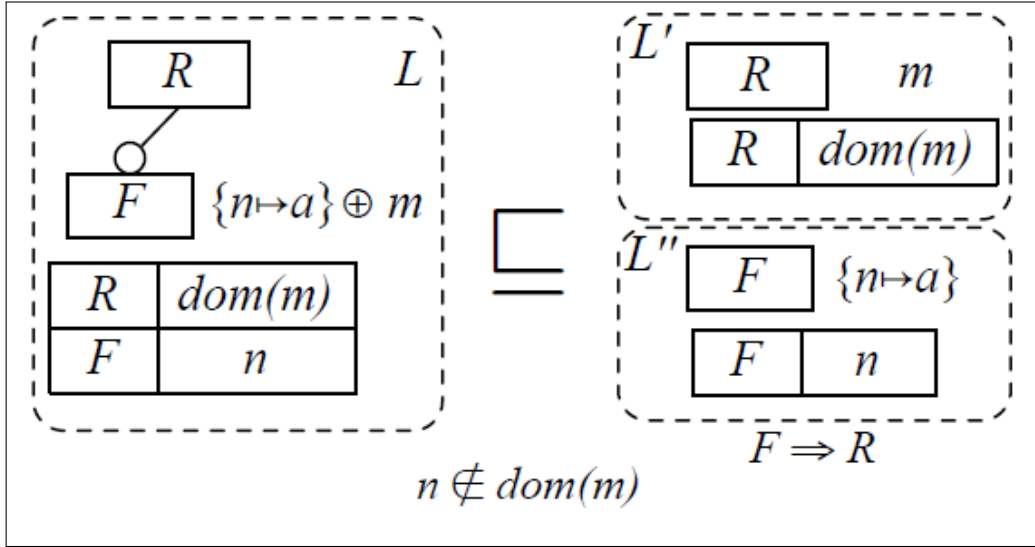Figure 13: Merge Products Into a PL (Taken from [**?**])

Figure 14: Derive Multi Product Line from a Product Line (Taken from [?
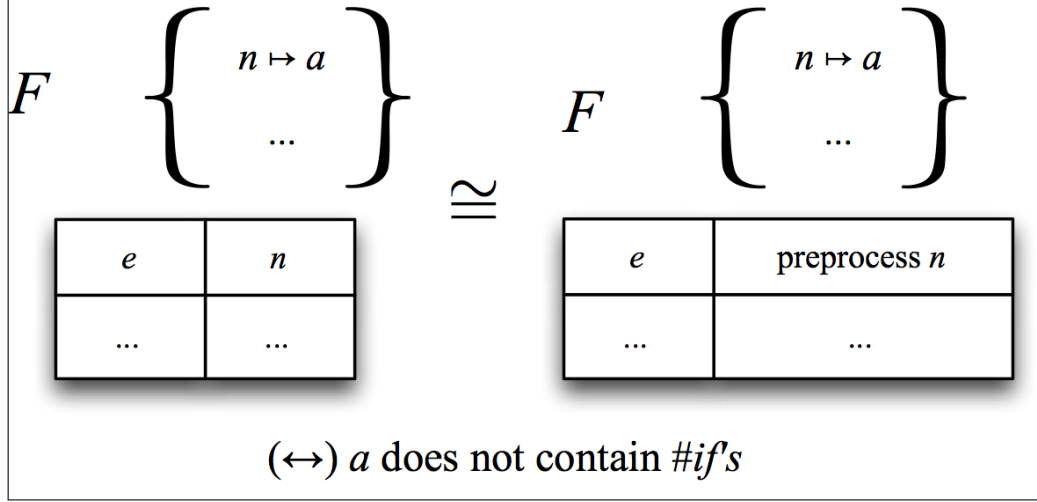])

2 Templates for Annotative Product Lines

$$F \left\{ \begin{array}{c} n \mapsto a \\ \ldots \end{array} \right\}$$

e	n
...	...

$\cong$

$$F \left\{ \begin{array}{c} n \mapsto a \\ \ldots \end{array} \right\}$$

e	preprocess n
...	...

($\leftrightarrow$) a does not contain #if's

Figure 15: Preprocess Asset Without Preprocessor Directive (Taken from [**?**])

$$F \left\{ \begin{array}{c} n \mapsto a[\text{-}] \\ \ldots \end{array} \right\}$$

e	preprocess n
...	...

$\cong$

$$F \left\{ \begin{array}{c} n \mapsto a[\#\text{if } x \ c] \\ \ldots \end{array} \right\}$$

e	preprocess n
...	...

($\leftrightarrow$) n does not appear in other CK lines
($\rightarrow$) x is a new tag
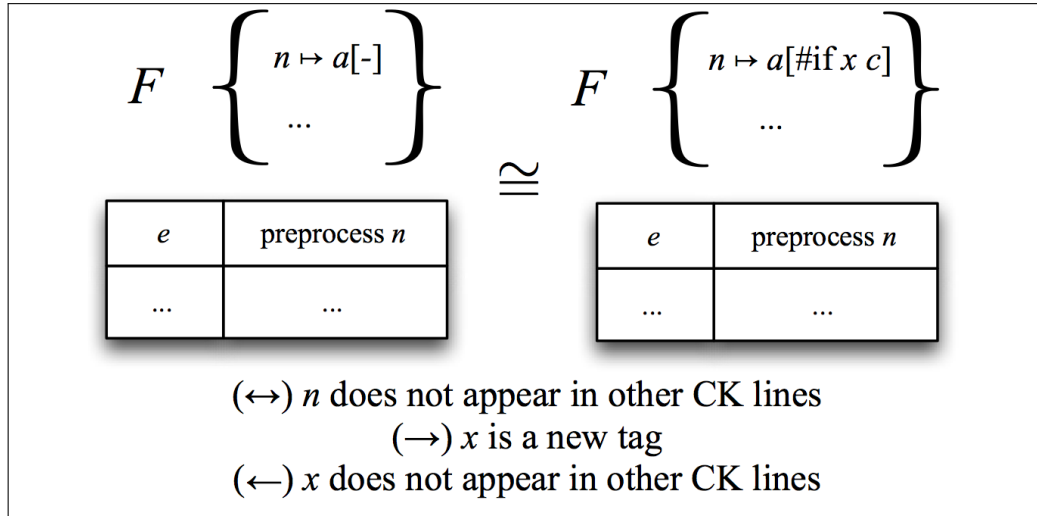($\leftarrow$) x does not appear in other CK lines
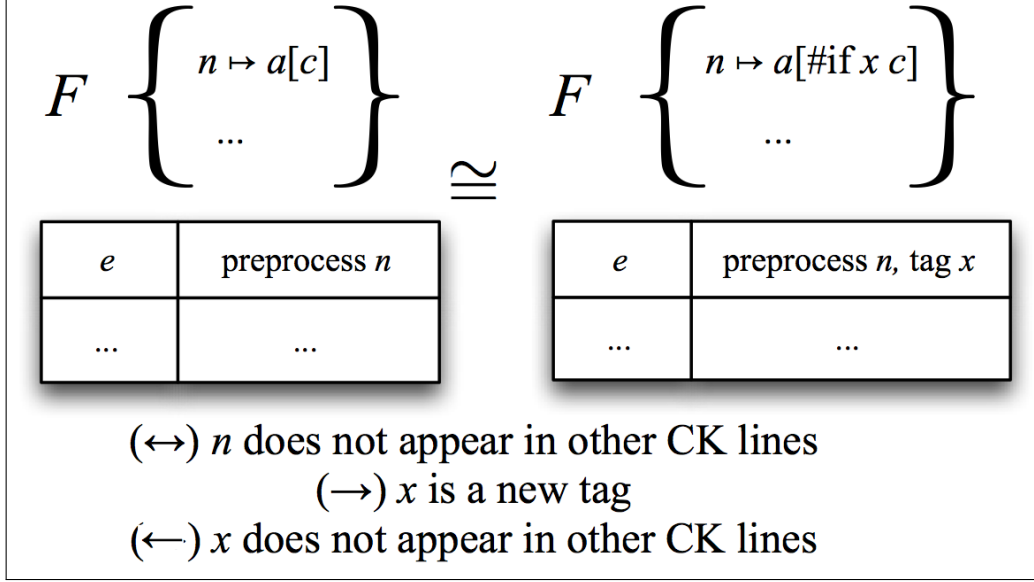
Figure 16: Add Dead Preprocessed Code (Taken from [**?**])

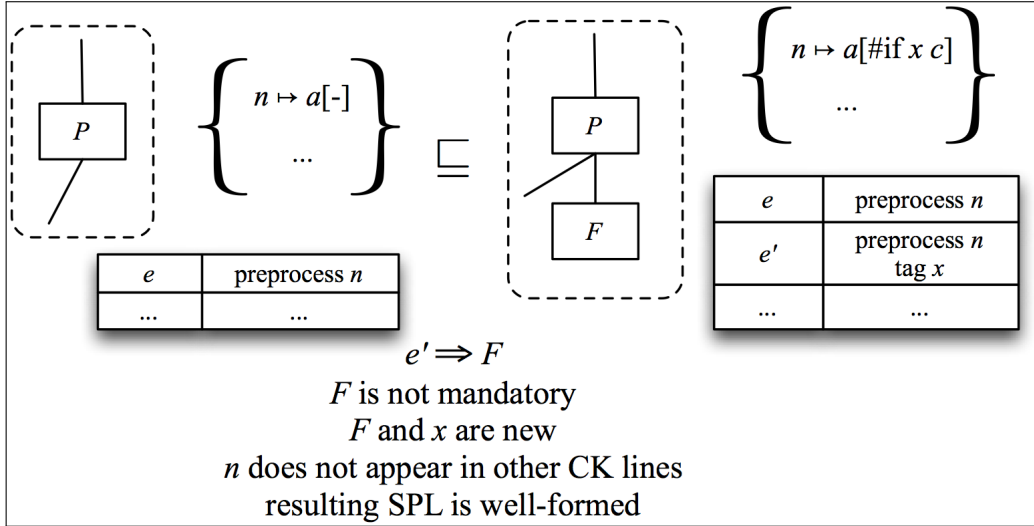Figure 17: Add Harmless Preprocessing Directive (Taken from [?])
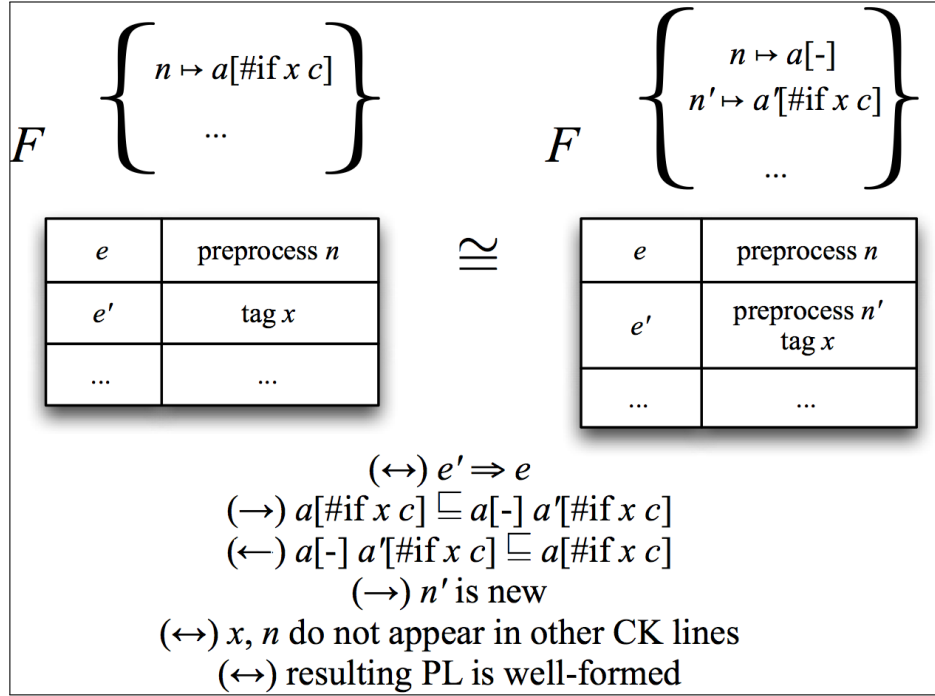

Figure 18: Add New Preprocessed Feature (Taken from [?])

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$$(\leftrightarrow)\ e' \Rightarrow e$$
$$(\rightarrow)\ a[\#\text{if } x\ c] \sqsubseteq a[\text{-}]\ a'[\#\text{if } x\ c]$$
$$(\leftarrow)\ a[\text{-}]\ a'[\#\text{if } x\ c] \sqsubseteq a[\#\text{if } x\ c]$$
$$(\rightarrow)\ n'\ \text{is new}$$
$$(\leftrightarrow)\ x, n\ \text{do not appear in other CK lines}$$
$$(\leftrightarrow)\ \text{resulting PL is well-formed}$$

Figure 19: Extract Preprocessed Code (Taken from [?])

a' is not referred to in any other asset in the Asset Mapping

n' do not show up in other CK lines
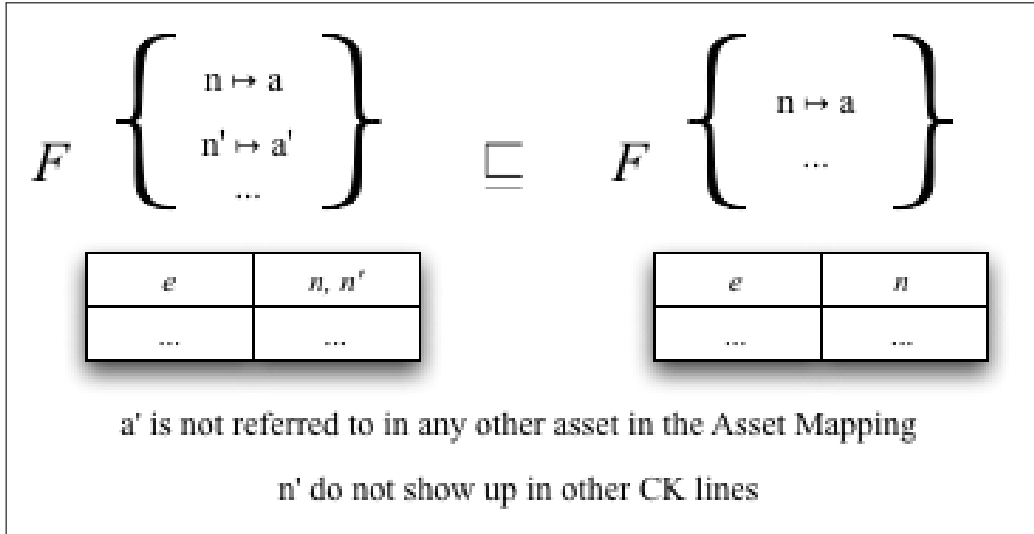
Figure 20: Delete Asset (Taken from [?])

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3 Templates for CK Refactoring

Feature Expression	Assets		Feature Expression	Assets
...	...	=	...	...
exp	a1		exp'	a1

exp ⇔ exp'
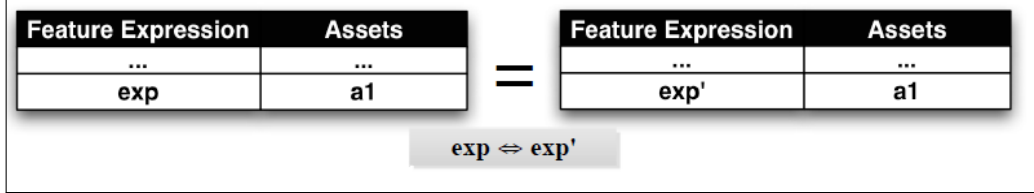
Figure 21: Simplify Feature Expression using Propositional Reasoning (Taken from [**?**])

Feature Expression	Assets		Feature Expression	Assets
...	...	=	...	...
exp	a1	*fm*	exp'	a1

fm ⊢ (exp ⇔ exp')
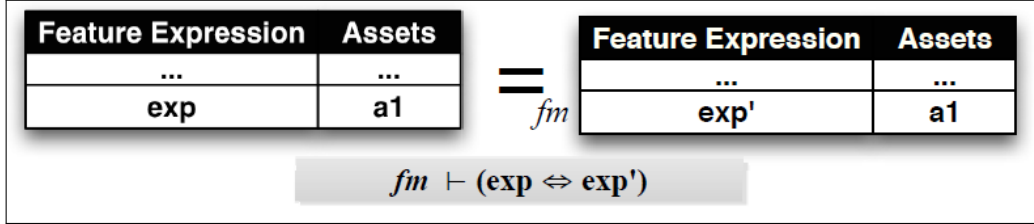
Figure 22: Simplify Feature Expression using the FM (Taken from [**?**])

Feature Expression	Assets		Feature Expression	Assets
...	...	=	...	...
exp	a1		exp	a1, a2
exp'	a2			

exp ⇔ exp'
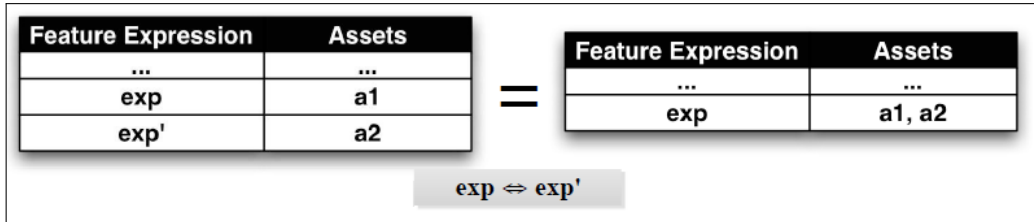
Figure 23: Merge items with propositionally equivalent feature expressions (Taken from [**?**])

Feature Expression	Assets
...	...
exp	a1
exp'	a2

$=_{fm}$

Feature Expression	Assets
...	...
exp	a1, a2

$$fm \vdash (exp \Leftrightarrow exp')$$
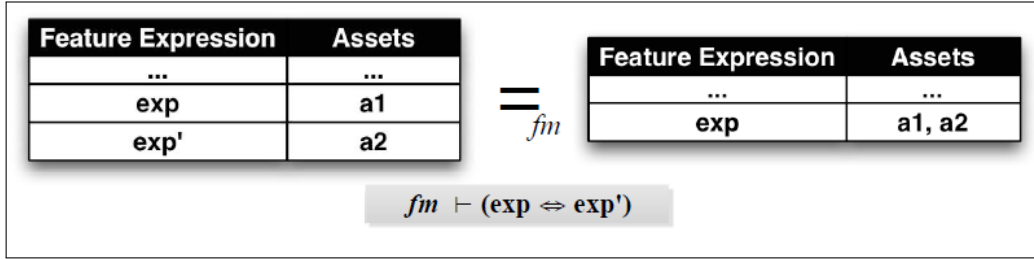
Figure 24: Merge items with equivalent feature expressions by the FM (Taken from [?])

Feature Expression	Assets
...	...
exp	a1
exp'	a1

$=$

Feature Expression	Assets
...	...
exp ∨ exp'	a1

Figure 25: Duplicated Assets (Taken from [?])

Feature Expression	Assets
...	...
exp'	a1
exp	a2

$=_{fm}$

F	Assets
...	...
exp	a1

$$fm \vdash \neg\, exp$$
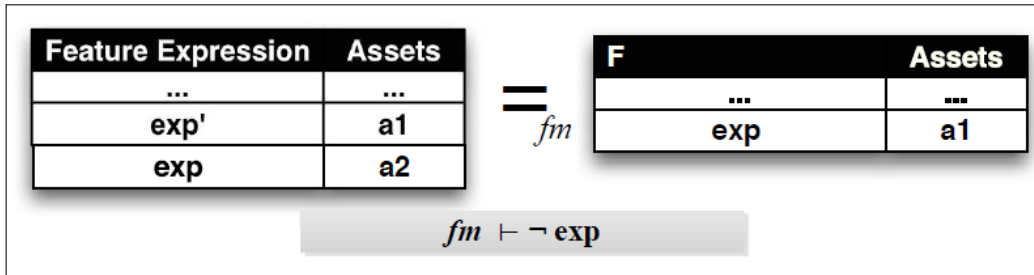
Figure 26: Dead Feature Expression (Taken from [?])

Feature Expression	Assets
...	...
exp	a1
exp'	a2

$=$

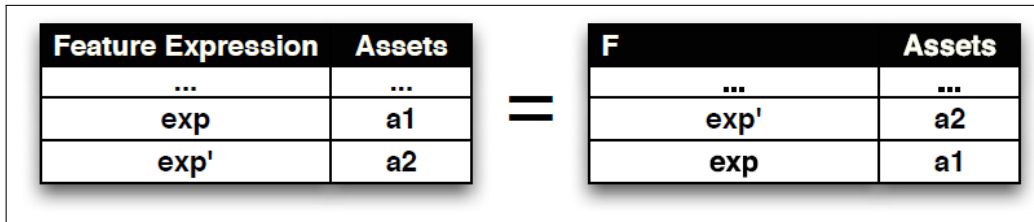| F	Assets
...	...
exp'	a2
exp	a1

Figure 27: Change Order (Taken from [?])
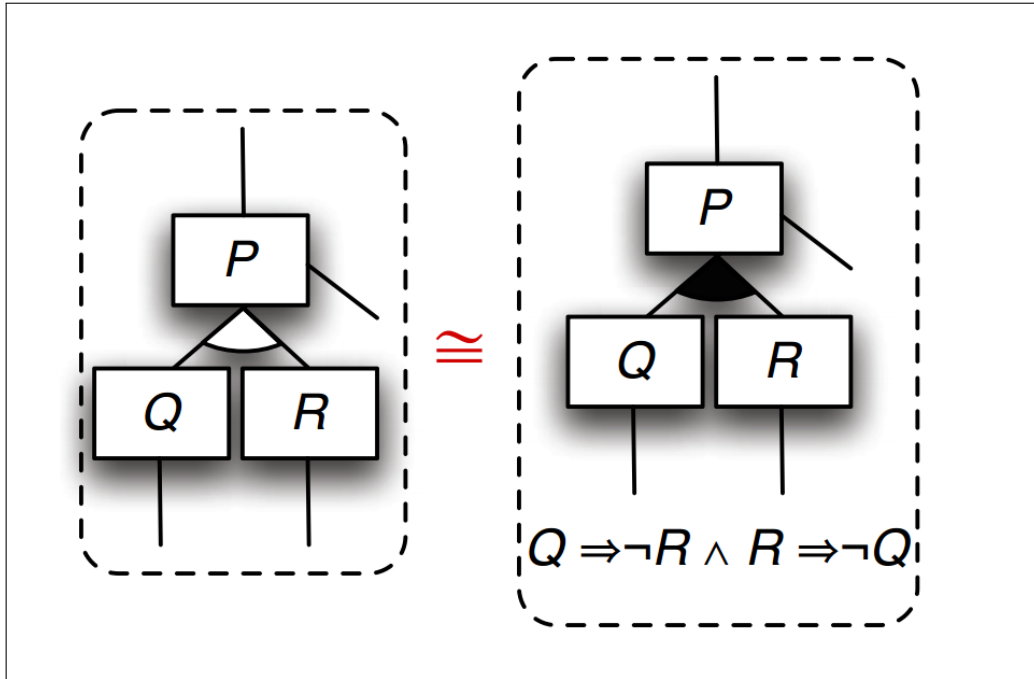
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4 Templates for FM Refactoring

Figure 28: Replace Alternative Equivalence Template (Taken from [**?**])
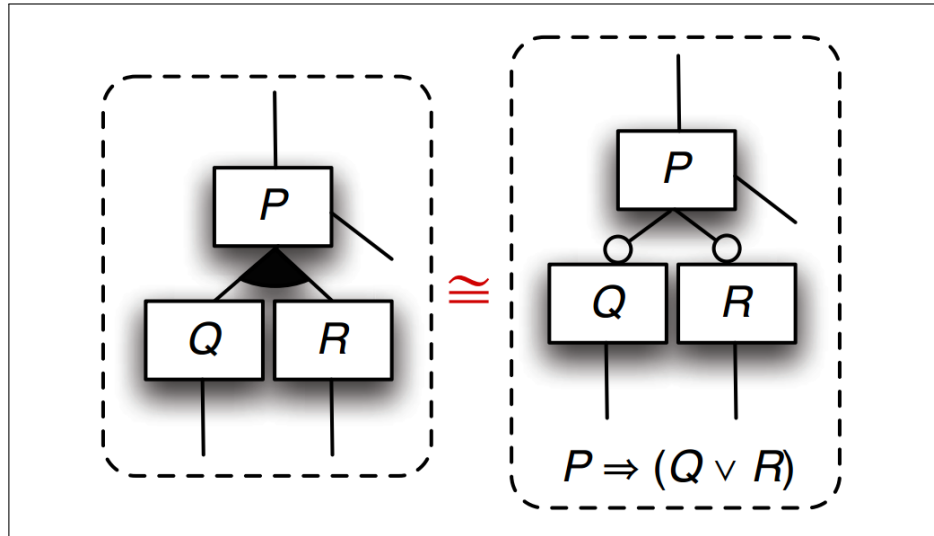
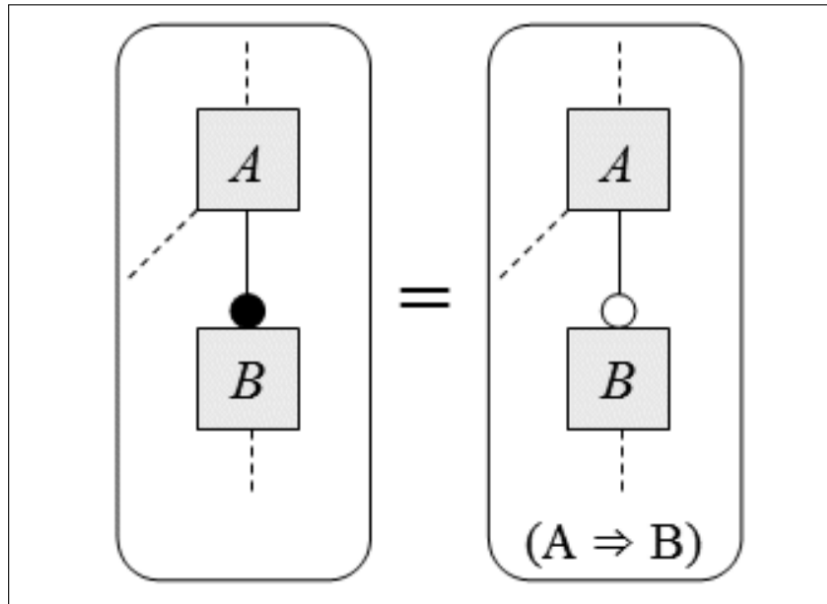Figure 29: Replace Or Equivalence Template (Taken from [?])
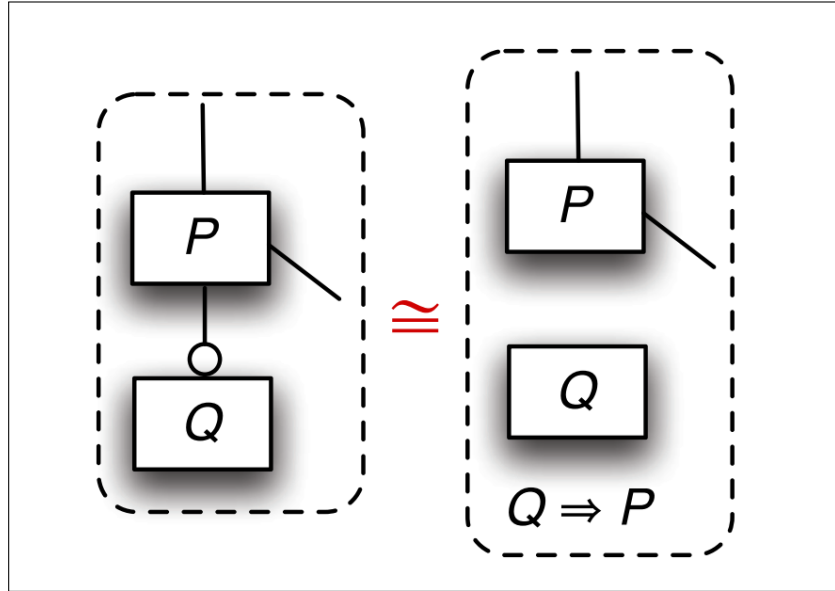

Figure 30: Replace Mandatory (Taken from [?])

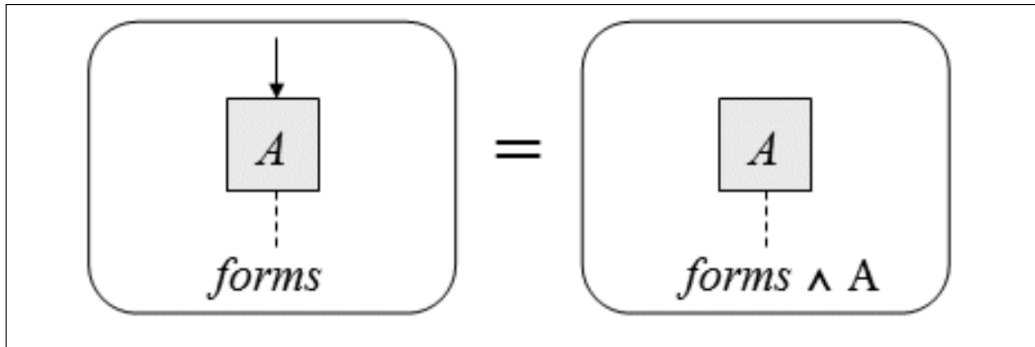Figure 31: Remove Optional Equivalence Template (Taken from [**?**])
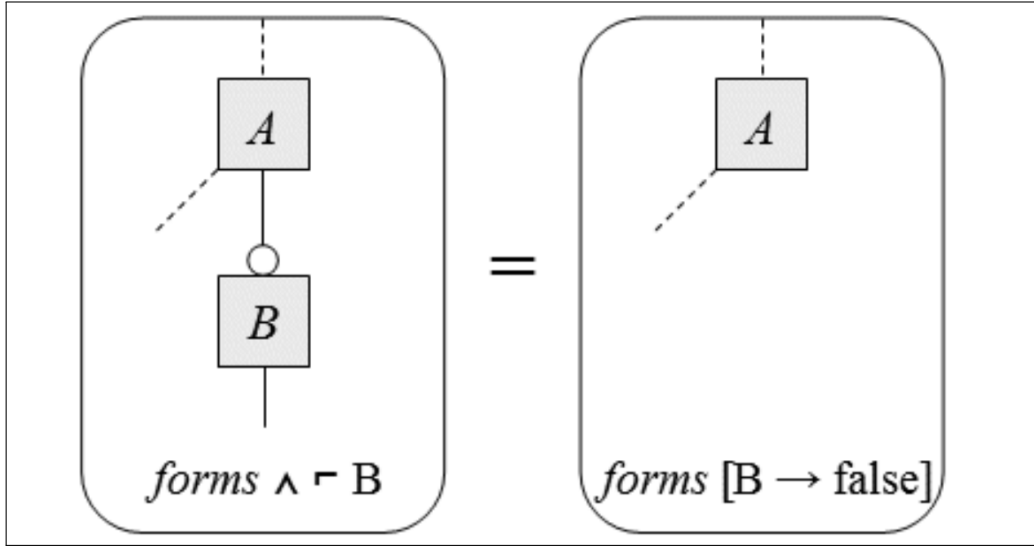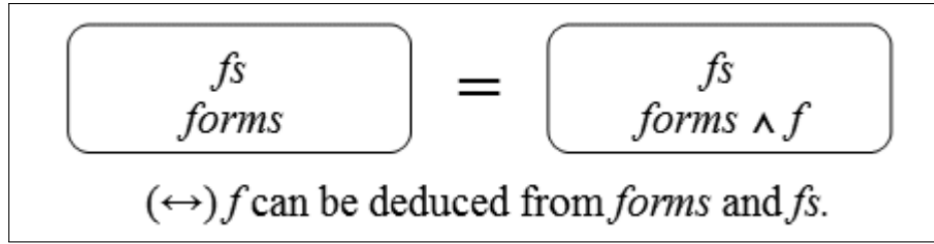

Figure 32: Remove Root (Taken from [**?**])

Figure 33: Remove Node (Taken from [**?**])

Figure 34: Add Formula (Taken from [**?**])