

$X \rightarrow Y \vee Z, Y \rightarrow Z, \neg(X \rightarrow Z)$ | α -EXPANSION $X \rightarrow Y \vee Z, X \rightarrow Z, Y \rightarrow Z, X, \neg Z$ β -EXPANSION $\underline{X \rightarrow Y \vee Z}, \underline{\neg Y}, X, \neg Z$ $X \rightarrow Y \vee Z, \underline{\exists}, X, \neg Z$ UNSATISFIABLE β -EXPANSION

UNSATISFIABLE

 $\neg \underline{X}, \neg Y, \underline{X}, \neg Z$ $\underline{Y \vee Z}, \neg Y, X, \neg Z$

UNSATISFIABLE

UNSATISFIABLE

 $Z, \neg Y, X, \neg Z$ WE HAVE PROVED THE PROPOSITION. THEREFORE, $F \models \varphi$

$$b) Y \rightarrow X \vee Z, Z \rightarrow \neg Y, X \wedge Z \rightarrow Y, \neg Z \rightarrow \neg X \models X \leftrightarrow Y$$

TRUTH TABLE

X	Y	Z	$X \vee Z$	F_1	$\neg Y$	F_2	$X \wedge Z$	F_3	$\neg Z$	$\neg X$	F_4	φ
0	0	0	0	1	1	1	0	1	1	1	1	1
0	0	1	1	1	1	1	0	1	0	1	1	1
0	1	0	0	0	0	1	0	1	1	1	1	0
0	1	1	1	1	0	0	0	1	0	1	1	0
1	0	0	1	1	1	1	0	1	1	0	0	0
1	0	1	1	1	1	1	1	0	0	0	1	0
1	1	0	1	0	0	1	0	0	1	0	0	1
1	1	1	1	1	0	0	1	1	0	0	1	1

$$F \models \varphi$$

VALUATIONS

$$Y \rightarrow X \vee Z, Z \rightarrow \neg Y, X \wedge Z \rightarrow Y, \neg Z \rightarrow \neg X, \neg(X \leftrightarrow Y)$$

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$$Y \rightarrow X \vee Z, Z \rightarrow \neg Y, X \wedge Z \rightarrow Y, \neg Z \rightarrow \neg X, \underline{\neg(X \rightarrow Y)}, \underline{\neg(Y \rightarrow X)}$$

1 d-EXPANSION

1 2

UNSATISFIABLE

$$Y \rightarrow X \vee Z, Z \rightarrow \neg Y, X \wedge Z \rightarrow Y, \neg Z \rightarrow \neg X, \underline{\neg(X \rightarrow Y)}, \underline{\neg(Y \rightarrow X)}$$



$$C) X \wedge Y \rightarrow Z, X \leftrightarrow Y, Z \rightarrow Y \models X \leftrightarrow Z$$

TRUTH TABLE

X	Y	Z	$X \wedge Y$	F_1	F_2	F_3	φ
0	0	0	0	1	1	1	1
0	0	1	0	1	1	0	0
0	1	0	0	1	0	1	1
0	1	1	0	1	0	1	0
1	0	0	0	1	0	1	0
1	0	1	0	1	0	0	1
1	1	0	1	0	1	1	0
1	1	1	1	1	1	1	1

$F \models \varphi$

VALUATIONS

$$X \wedge Y \rightarrow Z, X \leftrightarrow Y, Z \rightarrow Y, \neg(X \leftrightarrow Z)$$

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$$X \wedge Y \rightarrow Z, X \rightarrow Y, Y \rightarrow X, Z \rightarrow Y, \underline{\neg(X \rightarrow Z)}, \underline{\neg(Z \rightarrow X)}$$

| d-EXPANSION 1 2

$$X \wedge Y \rightarrow Z, X \rightarrow Y, Y \rightarrow X, Z \rightarrow Y, \underline{X}, \underline{\neg Z}, \underline{Z}, \underline{\neg X}$$

UNSATISFIABLE