Foundations of Artificial Intelligence
Exercise Sheet 4

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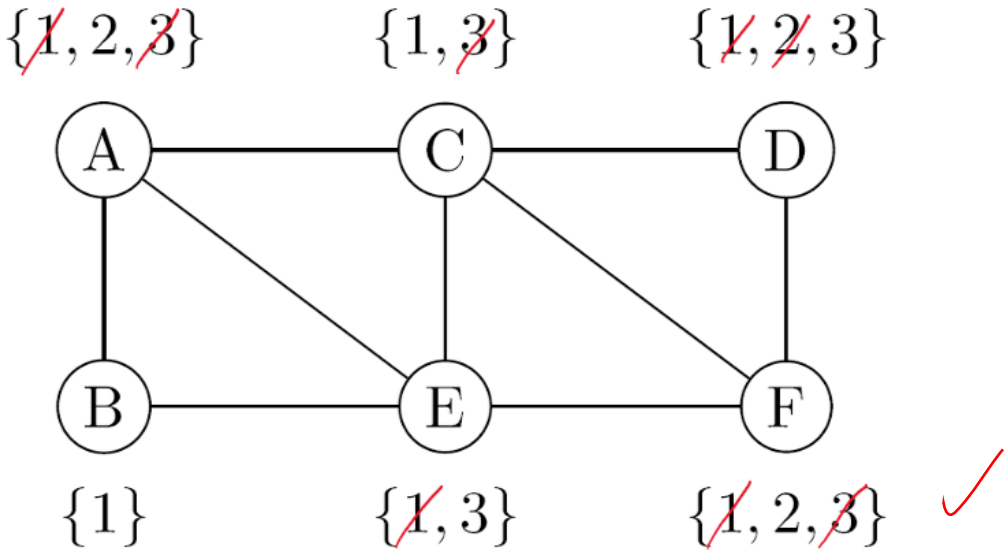
Exercise 4.1



Exercise 4.2

a)

a) valid and satisfiable

b) not valid but satisfiable

c) valid and satisfiable

d) not valid but satisfiable

e) not valid but satisfiable

b)

Truth table:

A	B	C	D	$A \wedge B$	$B \wedge C$	$(A \wedge B) \vee (B \wedge C)$	$A \vee B$	$A \leftrightarrow B$	$B \leftrightarrow C$	$(A \leftrightarrow B) \wedge (B \leftrightarrow C)$
0	0	0	1	0	0	0	0	1	1	1
0	0	1	0	0	0	0	0	1	0	0
0	0	1	1	0	0	0	0	1	0	0
0	1	0	0	0	0	0	1	0	0	0
0	1	0	1	0	0	0	1	0	0	0
0	1	1	0	0	1	1	1	0	1	0
0	1	1	1	0	1	1	1	0	1	0
1	0	0	0	0	0	0	1	0	1	0
1	0	0	1	0	0	0	1	0	1	0
1	0	1	0	0	0	0	1	0	0	0
1	0	1	1	0	0	0	1	0	0	0
1	1	0	0	1	0	1	1	1	0	0
1	1	0	1	1	0	1	1	1	0	0
1	1	1	0	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	1	1	1

By reading the Truthtable you can see that there are 6 possible models for $(A \wedge B) \vee (B \wedge C)$ (a)), 12 possible models for $A \vee B$ (b)) and 4 possible models for $(A \leftrightarrow B) \wedge (B \leftrightarrow C)$ (c))

Exercise 4.3

this negation does not survive

$$
\begin{aligned}
& (\neg X \to Y) \wedge ((X \wedge \neg Z) \leftrightarrow Y) \\
\Leftrightarrow\ & (\neg X \to Y) \wedge (((X \wedge \neg Z) \to Y) \wedge (Y \to (X \wedge \neg Z))) \\
\Leftrightarrow\ & (\neg X \vee Y) \wedge ((\neg(X \wedge \neg Z) \vee Y) \wedge (\neg Y \vee (X \wedge \neg Z))) \\
\Leftrightarrow\ & (\neg X \vee Y) \wedge ((\neg X \vee Z \vee Y) \wedge (\neg Y \vee (X \wedge \neg Z))) \\
\Leftrightarrow\ & (\neg X \vee Y) \wedge ((\neg X \vee Z \vee Y) \wedge ((\neg Y \vee X) \wedge (\neg Y \vee \neg Z))) \\
\Leftrightarrow\ & ((\neg X \vee Y) \vee (\neg X \vee Z \vee Y)) \wedge ((\neg X \vee Y) \vee ((\neg Y \vee X) \wedge (\neg Y \vee \neg Z))) \\
\Leftrightarrow\ & (\neg X \vee Z \vee Y) \wedge ((\neg X \vee Y) \vee (\neg Y \vee X)) \wedge ((\neg X \vee Y) \vee (\neg Y \vee \neg Z)) \\
\Leftrightarrow\ & \neg X \vee Z \vee Y
\end{aligned}
$$

this would be the CNF

clause set is missing