

Here are the answers to the homework. For some of these problems, there may be other, correct ways to solve them. Please email me if you have any questions, or if you find any mistakes.

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7.

1. $Q \supset (R \supset S)$
2. $Q \supset R$
 $\therefore Q \supset S$
3. $(Q \cdot R) \supset S$ Exp 1
4. $Q \supset (Q \cdot R)$ Abs 2
5. $Q \supset S$ HS 3,4

8.

1. $T \supset U$
2. $\sim(U \vee V)$ $\therefore \sim T$
3. $\sim U \cdot \sim V$ DeM 2
4. $\sim U$ Simp 3
5. $\sim T$ MT 1,4

9.

1. $W \cdot (X \vee Y)$
2. $\sim W \vee \sim X$ $\therefore W \cdot Y$
3. $(W \cdot X) \vee (W \cdot Y)$ Dist 1
4. $\sim(W \cdot X)$ DeM 2
5. $W \cdot Y$ DS 3,4

10.

1. $(Z \vee A) \vee B$
2. $\sim A$ $\therefore Z \vee B$
3. $(A \vee Z) \vee B$ Comm 1
4. $A \vee (Z \vee B)$ Ass 3
5. $Z \vee B$ DS 2,4

11.

1. $(C \vee D) \supset (E \cdot F)$
2. $D \vee C$ $\therefore E$
3. $C \vee D$ Comm 2
4. $E \cdot F$ MP 1,3
5. E Simp 4

12.

1. $G \supset H$
2. $H \supset G$ $\therefore (G \cdot H) \vee (\sim G \cdot \sim H)$

3. $(G \supset H) \cdot (H \supset G)$ Conj 1,2
4. $G \equiv H$ Equiv 3
5. $(G \cdot H) \vee (\sim G \cdot \sim H)$ Equiv 4

13.

1. $(I \supset J) \cdot (K \supset L)$
2. $I \vee (K \cdot M)$ $\therefore J \vee L$
3. $(I \vee K) \cdot (I \vee M)$ Dist 2
4. $I \vee K$ Simp 3
5. $J \vee L$ CD 1, 4

14.

1. $(N \cdot O) \supset P$
2. $(\sim P \supset \sim O) \supset Q$ $\therefore N \supset Q$
3. $N \supset (O \supset P)$ Exp 1
4. $(O \supset P) \supset Q$ Trans 2
5. $N \supset Q$ HS 3,4

15.

1. $[R \supset (S \supset T)] \cdot [(R \cdot T) \supset U]$
2. $R \cdot (S \vee T)$ $\therefore T \vee U$
3. $[(R \cdot S) \supset T] \cdot [(R \cdot T) \supset U]$ Exp 1
4. $(R \cdot S) \vee (R \cdot T)$ Dist 2
5. $T \vee U$ CD 3,4

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1 and 2 are done in the book.

3.

1. $E \supset (F \supset G)$ $\therefore F \supset (E \supset G)$
2. $\sim E \vee (F \supset G)$ Impl 1
3. $\sim E \vee (\sim F \vee G)$ Impl 2
4. $(\sim F \vee G) \vee \sim E$ Comm 3
5. $\sim F \vee (G \vee \sim E)$ Ass 4
6. $\sim F \vee (\sim E \vee G)$ Comm 5
7. $\sim F \vee (E \supset G)$ Impl 6
8. $F \supset (E \supset G)$ Impl 7

4.

1. $H \supset (I \cdot J)$ $\therefore H \supset I$
2. $\sim H \vee (I \cdot J)$ Impl 1
3. $(\sim H \vee I) \cdot (\sim H \vee J)$ Dist 2
4. $\sim H \vee I$ Simp 3
5. $H \supset I$ Impl 4

- 5.
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|----|--------------------------|-----------------------------------|
| 1. | $K \supset L$ | $\therefore K \supset (L \vee M)$ |
| 2. | $\sim K \vee L$ | Impl 1 |
| 3. | $(\sim K \vee L) \vee M$ | Add 2 |
| 4. | $\sim K \vee (L \vee M)$ | Ass 3 |
| 5. | $K \supset (L \vee M)$ | Impl 4 |

- 6.
- | | | |
|----|-------------------------------|------------------------------------|
| 1. | $N \supset O$ | $\therefore (N \cdot P) \supset O$ |
| 2. | $\sim N \vee O$ | Impl 1 |
| 3. | $(\sim N \vee O) \vee \sim P$ | Add 2 |
| 4. | $\sim N \vee (O \vee \sim P)$ | Ass 3 |
| 5. | $\sim N \vee (\sim P \vee O)$ | Comm 4 |
| 6. | $(\sim N \vee \sim P) \vee O$ | Ass 5 |
| 7. | $\sim(N \cdot P) \vee O$ | DeM 6 |
| 8. | $(N \cdot P) \supset O$ | Impl 7 |

- 7.
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|----|---|--------------------------|
| 1. | $(Q \vee R) \supset S$ | $\therefore Q \supset S$ |
| 2. | $\sim(Q \vee R) \vee S$ | Impl 1 |
| 3. | $(\sim Q \cdot \sim R) \vee S$ | DeM 2 |
| 4. | $S \vee (\sim Q \cdot \sim R)$ | Comm 3 |
| 5. | $(S \vee \sim Q) \cdot (S \vee \sim R)$ | Dist 4 |
| 6. | $S \vee \sim Q$ | Simp 5 |
| 7. | $\sim Q \vee S$ | Comm 6 |
| 8. | $Q \supset S$ | Impl 7 |

- 8.
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|----|---|------------------------------------|
| 1. | $T \supset U$ | |
| 2. | $T \supset V$ | $\therefore T \supset (U \cdot V)$ |
| 3. | $\sim T \vee U$ | Impl 1 |
| 4. | $\sim T \vee V$ | Impl 2 |
| 5. | $(\sim T \vee U) \cdot (\sim T \vee V)$ | Conj 3,4 |
| 6. | $\sim T \vee (U \cdot V)$ | Dist 5 |
| 7. | $T \supset (U \cdot V)$ | Impl 6 |

- 9.
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|----|-----------------|-----------------------------------|
| 1. | $W \supset X$ | |
| 2. | $Y \supset X$ | $\therefore (W \vee Y) \supset X$ |
| 3. | $\sim W \vee X$ | Impl 1 |
| 4. | $\sim Y \vee X$ | Impl 2 |
| 5. | $X \vee \sim W$ | Comm 3 |
| 6. | $X \vee \sim Y$ | Comm 4 |

7. $(X \vee \sim W) \cdot (X \vee \sim Y)$ Conj 5,6
8. $X \vee (\sim W \cdot \sim Y)$ Dist 7
9. $(\sim W \cdot \sim Y) \vee X$ Comm 8
10. $\sim(W \vee Y) \vee X$ DeM 9
11. $(W \vee Y) \supset X$ Impl 10

10.

1. $Z \supset A$
2. $Z \vee A$ $\therefore A$
3. $\sim\sim Z \vee A$ DN 2
4. $\sim Z \supset A$ Impl 3
5. $\sim A \supset \sim\sim Z$ Trans 4
6. $\sim A \supset Z$ DN 5
7. $\sim A \supset A$ HS 6,1
8. $\sim\sim A \vee A$ Impl 7
9. $A \vee A$ DN 8
10. A Taut 9