

Practice Test 7, solutions below

Problem 1

1. $\neg(p \ \& \ q)$ A
2. $\neg(\neg p \vee \neg q)$ A
3. Show: r

Problem 2

1. $(p \leftrightarrow q) \rightarrow \neg(r \rightarrow s)$ A
2. $\neg p \vee q$ A
- 3 $\neg(q \ \& \ \neg p)$ A
4. Show: $\neg(\neg r \vee s)$

Problem 3

1. $(p \vee q) \vee (r \vee s)$ A
2. $\neg r$ A
3. $\neg(t \rightarrow s)$ A
4. Show $\neg p \rightarrow q$

Problem 1

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|----|----------------------------|-------------|
| 1. | $\neg(p \& q)$ | A |
| 2. | $\neg(\neg p \vee \neg q)$ | A |
| 3. | Show: r | |
| 4. | $\neg p \& \neg q$ | $\neg\&, 2$ |
| 5. | $p \& \neg q$ | $\neg\&, 4$ |
| 6. | $p \& q$ | $\neg\&, 5$ |
| 7. | r | $!, 1,6$ |

Problem 2

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|-----|---|---------------------------|
| 1. | $(p \leftrightarrow q) \rightarrow \neg(r \rightarrow s)$ | A |
| 2. | $\neg p \vee q$ | A |
| 3. | $\neg(q \& \neg p)$ | A |
| 4. | Show: $\neg(\neg r \vee s)$ | |
| 5. | $(\neg r \vee s)$ | AIP |
| 6. | $p \rightarrow q$ | $\rightarrow\vee, 2$ |
| 7. | $\neg q \vee \neg p$ | $\neg\&, 3$ |
| 8. | $\neg q \vee p$ | $\neg\&, 7$ |
| 9. | $q \rightarrow p$ | $\rightarrow\vee, 8$ |
| 10. | $p \leftrightarrow q$ | $\leftrightarrow\&, 6, 9$ |
| 11. | $\neg(r \rightarrow s)$ | $\rightarrow E, 1,10$ |
| 12. | $(\neg r \vee \neg s)$ | $\neg\&, 5$ |
| 13. | $\neg(r \& s)$ | $\neg\&, 12$ |
| 14. | $r \& \neg s$ | $\neg\rightarrow, 11$ |

Problem 3

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|-----|------------------------------|-----------------------|
| 1. | $(p \vee q) \vee (r \vee s)$ | A |
| 2. | $\neg r$ | A |
| 3. | $\neg(t \rightarrow s)$ | A |
| 4. | Show $\neg p \rightarrow q$ | |
| 5. | Show $p \vee q$ | |
| 6. | $t \& \neg s$ | $\neg\rightarrow, 3$ |
| 7. | $\neg s$ | $\&E, 6$ |
| 8. | $\neg r \& \neg s$ | $\&I, 2,7$ |
| 9. | $\neg(r \vee s)$ | $\neg\vee, 8$ |
| 10. | $p \vee q$ | $\vee E^*, 1,9$ |
| 11. | $\neg p \vee q$ | $\neg\&, 5$ |
| 12. | $\neg p \rightarrow q$ | $\rightarrow\vee, 11$ |

Note: this proof can also be done as a conditional proof. Sometimes, however, it is just as easy to prove the equivalent disjunction, and convert it into a conditional at the end.