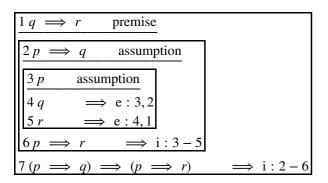
Homework 1

1.



2.

$1 \neg p$	assumption			
2 p	assumption			
3 p	assumption			
4 ⊥	¬e:3,1			
$\int q$	⊥e : 4			
6p =		i:3-5	i : 2 – 6	
$\begin{vmatrix} p & p \\ 8 & p \end{vmatrix} =$	$\Rightarrow (p \implies q)$ $\Rightarrow (n \implies (n \implies q)$	$ \longrightarrow q))$	1:2-0	. i · 1 – 7

3.

1				
$1 p \implies q$ premise				
$2 \neg (\neg p \lor q)$ assumption				
$3 \neg p$ assumption				
$ 4 \neg p \lor q \qquad \lor i_1 : 3 $				
5 ⊥ ¬e: 4,2				
6p RAA: 3 – 5				
7 q assumption				
$8 \neg p \lor q \qquad \lor i_2 : 7$				
9 ⊥ ¬e: 8, 2				
$10 \ \neg q \qquad \neg i : 7 - 9$				
$11 q \implies e: 6, 1$				
12 ⊥ ¬e: 11, 10				
$13 \neg p \lor q$ RAA: $2 - 12$				

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1 (s \implies p) \lor (t \implies q)
                                 premise
                                                                22 t \implies q
2 s \implies p assumption
                                                                                assumption
              LEM
                                                                23 \ t \lor \neg t
                                                                               LEM
3 s \lor \neg s
 4 s
        assumption
                                                                24 t
                                                                          assumption
 5 p
          \implies e: 4, 2
                                                                25 q
                                                                          \implies e: 24, 22
6 \neg s \lor p \qquad \lor i_2 : 5
                                                                26 \neg t \lor q \qquad \lor i_2 : 25
7 \neg s assumption
                                                                27 \neg t
                                                                          assumption
 8 \neg s \lor p \lor i_1 : 7
                                                                28 \neg t \lor q \qquad \lor i_1 : 27
             \vee e: 3,4 – 6,7 – 8
                                                                               \vee e: 23, 24 – 26, 27 – 28
9 \neg s \lor p
                                                                29 \neg t \lor q
 10 \neg s assumption
                                                                30 \neg t
                                                                            assumption
 11 s
          assumption
                                                                 31 t assumption
           \neg e: 11, 10
                                                                            \neg e: 31.30
 12 ⊥
                                                                 32 ⊥
 13 q \perpe: 12
                                                                 33 p \perp e : 32
 14 s \implies q \implies i:11-13
                                                                 34 t \implies p \implies i: 31 - 33
 15 (s \implies q) \lor (t \implies p) \lor i_1 : 14
                                                                35 (s \implies q) \lor (t \implies p) \lor i_2 : 34
 16 p
           assumption
                                                                36 q
                                                                           assumption
 17 t
                                                                 37 s
                                                                         assumption
          assumption
                                                                 38 q
 18 p
                                                                39 s \implies q \implies i: 37 - 38
 19 t \implies p \implies i:17-18
                                                                40 (s \implies q) \lor (t \implies p) \qquad \lor i_1 : 39
20 (s \implies q) \lor (t \implies p) \lor i_2 : 19
21 (s \implies q) \lor (t \implies p) \qquad \lor e: 9, 10-15, 16-20 \quad 41 (s \implies q) \lor (t \implies p) \qquad \lor e: 29, 30-35, 36-40
42 (s \implies q) \lor (t \implies p) \qquad \lor e: 1, 2-21, 22-41
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5.

$$\begin{array}{cccc}
1 & (p \wedge q) & \Longrightarrow r & \text{premise} \\
2 & r & \Longrightarrow s & \text{premise} \\
\hline
3 & q \wedge \neg s & \text{premise} \\
\hline
4 & \neg s & \wedge e_2 : 3 \\
5 & \neg r & \text{MT} : 2, 4 \\
6 & \neg (p \wedge q) & \text{MT} : 1, 5
\end{array}$$

$$\begin{array}{cccc}
\hline
7 & \text{assumption} \\
8 & q & \wedge e_1 : 3 \\
9 & p \wedge q & \wedge i : 7, 8 \\
10 & \bot & \neg e : 9, 6
\end{array}$$

$$\begin{array}{cccc}
11 & \neg p & \neg i : 7 - 10
\end{array}$$