

Extra ND Exercises up through \rightarrow I, \neg I, and \neg E
 PHI 154 (Eliot)
 REVISED

Use our natural deduction proof system to prove the validity of each of the following arguments. The first column does not require the negation rules (\neg I, and \neg E), and then some of the right column does start to require them.

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| <p>1. $A \rightarrow (C \vee \neg B)$
 $\frac{(R \wedge P) \wedge (R \rightarrow A)}{C \vee \neg B}$</p> | <p>14. $\frac{\neg E \wedge E}{A}$</p> |
| <p>2. $N \rightarrow (\neg M \rightarrow \neg O)$
 $\frac{(N \leftrightarrow \neg M) \wedge N}{\neg O}$</p> | <p>15. $\frac{\neg F \wedge F}{B \wedge \neg B}$</p> |
| <p>3. $\neg H \leftrightarrow I$
 $G \leftrightarrow \neg H$
 $\frac{I \leftrightarrow \neg E}{\neg E \rightarrow G}$</p> | <p>16. $\frac{F \wedge (\neg J \wedge K)}{\neg(K \wedge \neg F)}$</p> |
| <p>4. $\frac{P \wedge R}{C \rightarrow (R \wedge P)}$</p> | <p>17. $R \leftrightarrow \neg H$
 $\frac{R \wedge M}{H \rightarrow \neg P}$</p> |
| <p>5. $M \leftrightarrow (D \wedge N)$
 $\frac{(N \wedge D) \rightarrow M}{\neg(R \wedge \neg Q)}$</p> | <p>18. $\frac{Q \leftrightarrow R}{\neg(R \wedge \neg Q)}$</p> |
| <p>6. $(B \rightarrow C) \wedge (U \rightarrow D)$
 $\frac{B \wedge (U \wedge F)}{D \wedge C}$</p> | <p>19. $S \rightarrow \neg D$
 $\neg(S \rightarrow E)$
 $\frac{E \leftrightarrow \neg D}{R}$</p> |
| <p>7. $\frac{H \wedge L}{(B \rightarrow L) \wedge (A \rightarrow H)}$</p> | <p>20. $R \rightarrow M$
 $P \wedge (\neg F \vee \neg G)$
 $M \vee Q$
 $\frac{\neg M}{\neg R}$</p> |
| <p>8. $\frac{K}{K \rightarrow K}$</p> | <p>21. $\frac{P \wedge \neg R}{\neg(P \rightarrow R)}$</p> |
| <p>9. $\frac{F}{R \rightarrow (A \rightarrow F)}$</p> | <p>22. $\neg(L \vee M) \rightarrow O$
 $\frac{\neg E \wedge \neg O}{L \vee M}$</p> |
| <p>10. $N \vee P$
 $\frac{P \wedge (H \leftrightarrow P)}{(C \vee B) \rightarrow H}$</p> | <p>23. $(B \vee A) \rightarrow D$
 $\frac{D \rightarrow E}{B \rightarrow \neg\neg E}$</p> |
| <p>11. $\frac{E}{B \rightarrow (E \vee F)}$</p> | <p>24. $\frac{B \wedge C}{\neg(B \rightarrow \neg C)}$</p> |
| <p>12. $C \vee \neg A$
 $(T \leftrightarrow \neg E) \wedge M$
 $\frac{M \rightarrow \neg E}{T \vee B}$</p> | <p>25. $\neg(P \wedge \neg P)$ (prove without premises)</p> |
| <p>13. $K \wedge J$
 $M \rightarrow (\neg C \rightarrow E)$
 $\frac{(J \vee A) \rightarrow M}{\neg C \rightarrow E}$</p> | |