Introduction to Logical Reasoning

Workshop on Identifying Valid Argument Forms

Part I: Each of the following problems presents an valid argument. Use natural deduction to construct that argument's formal proof of validity. Each proof will only require *one* step, so essentially the task is to identify the one rule of inference that is enough to justify the conclusion from the stated premise(s).

1. 1. $X \rightarrow Y$.
   $\therefore$ $X \rightarrow (X \,\&\, Y)$.

2. 1. $(A \,\&\, B) \rightarrow C$.
   2. $\sim C$.
   $\therefore$ $\sim(A \,\&\, B)$.

3. 1. $(W \vee X) \rightarrow \sim(W \rightarrow X)$.
   2. $W \vee X$.
   $\therefore$ $\sim(W \rightarrow X)$.

4. 1. $\sim(M \rightarrow \sim N) \vee (Q \,\&\, R)$.
   2. $\sim\sim(M \rightarrow \sim N)$.
   $\therefore$ $Q \,\&\, R$.

5. 1. $[(W \vee \sim X) \rightarrow D] \,\&\, (H \vee R)$.
   $\therefore$ $(W \vee \sim X) \rightarrow D$.

6. 1. $(E \rightarrow F) \rightarrow G$.
   $\therefore$ $(E \rightarrow F) \rightarrow [(E \rightarrow F) \,\&\, G]$.

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Part II: Each of the following problems presents a complete and correct formal proof of validity for an argument by natural deduction. For each proof, state the justification for each step within that proof (i.e., the numbered steps that start after the conclusion has been indicated by the ∴).

1. 1. $(A \vee B) \rightarrow C$.
   2. $(C \vee B) \rightarrow [A \rightarrow (D \vee E)]$.
   3. $A \,\&\, D$.

   ∴ $D \vee E$.

   4. A. _____
   5. $A \vee B$. _____
   6. C. _____
   7. $C \vee B$. _____
   8. $A \rightarrow (D \vee E)$. _____
   9. $D \vee E$. _____

2. 1. $W \rightarrow X$.
   2. $(W \rightarrow Y) \rightarrow (Z \vee X)$.
   3. $(W \,\&\, X) \rightarrow Y$.
   4. $\sim Z$.

   ∴ X.

   5. $W \rightarrow (W \,\&\, X)$. _____
   6. $W \rightarrow Y$. _____
   7. $Z \vee X$. _____
   8. X. _____