Assignment 3

Give the number of the **Fundamental Equivalence** (p. 44) used for each step below:

32 $\neg 0 \sim 1$

$\neg 0 \sim \neg 0 \vee 0$ _____
$\sim 0 \vee \neg 0$ _____
~ 1 _____

33 $\neg 1 \sim 0$

$\neg 1 \sim \neg \neg 0$ _____
~ 0 _____

34 $P \to 0 \sim \neg P$

$P \to 0 \sim \neg P \vee 0$ _____
$\sim \neg P$ _____

35 $P \to 1 \sim 1$

$P \to 1 \sim \neg P \vee 1$ _____
~ 1 _____

36 $0 \to P \sim 1$

$0 \to P \sim \neg 0 \vee P$ _____
$\sim 1 \vee P$ _____
$\sim P \vee 1$ _____
~ 1 _____

37 $1 \to P \sim P$

$1 \to P \sim \neg 1 \vee P$ _____
$\sim 0 \vee P$ _____
$\sim P \vee 0$ _____
$\sim P$ _____

38 $P \to P \sim 1$

$P \to P \sim \neg P \vee P$ _____
$\sim P \vee \neg P$ _____
~ 1 _____

39 $P \leftrightarrow 0 \sim \neg P$

$P \leftrightarrow 0 \sim (P \to 0) \wedge (0 \to P)$ _____
$\sim \neg P \wedge (0 \to P)$ _____
$\sim \neg P \wedge 1$ _____
$\sim \neg P$ _____

40 $0 \leftrightarrow P \sim \neg P$

$0 \leftrightarrow P \sim P \leftrightarrow 0$ _____
$\sim \neg P$ _____

41 $P \leftrightarrow 1 \sim P$

$P \leftrightarrow 1 \sim (P \to 1) \wedge (1 \to P)$ _____
$\sim 1 \wedge (1 \to P)$ _____
$\sim 1 \wedge P$ _____
$\sim P \wedge 1$ _____
$\sim P$ _____

42 $1 \leftrightarrow P \sim P$

$1 \leftrightarrow P \sim P \leftrightarrow 1$ _____
$\sim P$ _____

43 $P \leftrightarrow P \sim 1$

$P \leftrightarrow P \sim (P \to P) \wedge (P \to P)$ _____
$\sim 1 \wedge 1$ _____
~ 1 _____

Adequate Sets of Connectives

Circle (or highlight) the formulas among $0, 1, P, \neg P$ that can be represented by a formula $F(P)$ using the connectives in $\mathcal{C}$:

Connectives				
$\mathcal{C} = \{\wedge, \vee\}$	0	1	P	$\neg P$
$\mathcal{C} = \{\wedge, 0\}$	0	1	P	$\neg P$
$\mathcal{C} = \{0, \leftrightarrow\}$	0	1	P	$\neg P$
$\mathcal{C} = \{\neg, \leftrightarrow\}$	0	1	P	$\neg P$
$\mathcal{C} = \{\rightarrow, 1\}$	0	1	P	$\neg P$

Circle (or highlight) the connectives that can be realized using the connectives in $\mathcal{C}$:

Connectives							
$\mathcal{C} = \{\wedge, \vee\}$	0	1	$\neg$	$\vee$	$\wedge$	$\rightarrow$	$\leftrightarrow$
$\mathcal{C} = \{\wedge, 0\}$	0	1	$\neg$	$\vee$	$\wedge$	$\rightarrow$	$\leftrightarrow$
$\mathcal{C} = \{0, \leftrightarrow\}$	0	1	$\neg$	$\vee$	$\wedge$	$\rightarrow$	$\leftrightarrow$
$\mathcal{C} = \{\neg, \leftrightarrow\}$	0	1	$\neg$	$\vee$	$\wedge$	$\rightarrow$	$\leftrightarrow$
$\mathcal{C} = \{\rightarrow, 1\}$	0	1	$\neg$	$\vee$	$\wedge$	$\rightarrow$	$\leftrightarrow$

Substitution/Replacement

In each of the following inferences you are to choose the best answer for how the inference could be accomplished. The four choices are: **substitution**, **replacement**, **both**, **neither**.

1. $\dfrac{P \sim Q}{P \wedge P \sim P \wedge Q}$ _____
2. $\dfrac{P \sim Q}{Q \sim P}$ _____
3. $\dfrac{P \rightarrow Q \sim \neg P \vee Q}{\neg P \vee Q \sim P \rightarrow Q}$ _____
4. $\dfrac{P \rightarrow Q \sim \neg P \vee Q}{Q \rightarrow (P \rightarrow Q) \sim Q \rightarrow (\neg P \vee Q)}$ _____
5. $\dfrac{P \rightarrow Q \sim \neg P \vee Q}{Q \rightarrow P \sim \neg Q \vee P}$ _____
