

Phl 313K  
Prof. Koons  
Spring '98

## FIRST MAJOR EXAM

**I. Derivations. 20 points each. Use your blue book. You may use derivable rules.**

- A.  $((P \& Q) \rightarrow R) \therefore ((\neg R \& Q) \rightarrow \neg P)$
- B.  $((Q \& \neg P) \rightarrow \neg R); (S \rightarrow R) \therefore ((Q \& S) \rightarrow P)$
- C.  $(P \leftrightarrow Q); ((P \rightarrow R) \vee (Q \rightarrow S)); (P \& \neg S) \therefore R$

**II. Multiple Choice questions. 3 points each. Choose the best answer and fill in the corresponding circle on your answer grid.**

### Translations

1. Which would be the best representation of "P only if Q"?

- (A)  $(P \rightarrow Q)$  (B)  $(Q \rightarrow P)$   
(C)  $(P \leftrightarrow Q)$  (D)  $(P \vee Q)$   
(E)  $(P \& (Q \rightarrow P))$

2. How could we represent the exclusive disjunction, "p or q but not both", using our symbolic language?

- (A)  $(P \vee Q)$  (B)  $\neg(P \vee Q)$   
(C)  $((P \rightarrow Q) \vee (\neg P \& \neg Q))$  (D)  $((P \vee Q) \& \neg(P \& Q))$   
(E)  $\neg((P \& Q) \& (P \vee Q))$

### Interpretations and Truth Tables

3. Which of the following would make the formula  $(\neg(P \vee Q) \leftrightarrow R)$  **false**?

- (A) P: true, Q: true, R: false.  
(B) P: false, Q: false, R: true.  
(C) P: false, Q: false, R: false.  
(D) P: false, Q: true, R: false  
(E) None of the above.



Phl 313K

Page 3

10. What is wrong with the following derivation?

1.	$(P \& Q)$	A
2.	$\neg\neg Q$	A
3.	Show $\neg P$	
4.	$P$	AIP
5.	$Q$	$\&E, 1$
6.	$\neg\neg Q$	$R, 2$

- (A) Improper assumption on line 4.  
 (B) Misuse of  $\&E$  on line 5.  
 (C) Misuse of  $R$  on line 6.  
 (D) Improper bracketing and cancelling of show line.  
 (E) Nothing is wrong.

11. What should be done **next** in the following derivation?

1.	$(P \vee \neg R)$	A
2.	$(R \leftrightarrow Q)$	A
3.	$(Q \rightarrow \neg P)$	A
4.	Show $\neg Q$	
5.	$Q$	AIP
6.	$\neg P$	$\rightarrow E, 3, 5$
7.	$R$	$\leftrightarrow E, 2, 5$

- (A) Bracket and cancel the show line.  
 (B) Apply  $\vee I$  to line 7 and get  $(\neg P \vee R)$   
 (C) Apply Double Negation to line 6 and get  $P$ .  
 (D) Apply  $\vee E^*$  to lines 1 and 6 to get  $\neg R$ .  
 (E) Apply  $\leftrightarrow E$  to lines 2 and 7 to get  $Q$ .

Phl 313K

Page 4

12. What would be the best way to show  $(\neg(P \& Q) \rightarrow R)$ ?

- (A) Start a conditional proof and assume  $\neg(P \& Q)$ .
- (B) Start an indirect proof and assume  $(\neg(P \& Q) \rightarrow \neg R)$ .
- (C) Start an indirect proof and assume  $\neg R$ .
- (D) Start a conditional proof and assume  $(P \& Q)$ .
- (E) Start an indirect proof, assume  $\neg R$ , and then try to show  $(P \& Q)$  by a conditional proof.

13. What follows **immediately** from  $\neg(\neg P \leftrightarrow R)$  by  $\neg \leftrightarrow$ ?

- (A)  $(\neg \neg P \leftrightarrow \neg R)$
- (B)  $(\neg R \leftrightarrow \neg \neg P)$
- (C)  $(\neg P \leftrightarrow \neg R)$
- (D)  $(\neg \neg P \& R)$
- (E)  $(\neg P \& \neg R)$

14. Which of the following could not be validly derived in a situation where both P and  $\neg P$  occur as available lines?

- (A) P
- (B)  $\neg P$
- (C) Q
- (D)  $(P \& \neg P)$
- (E) Any line can be validly inferred in this situation.