PHIL 120B – 1st Exam – Fri., June 30, 2006 – 100 points

1) (**20 points**) Consider the following assignments of wffs to metalogical variables:
A_1 : -P → (Q v R)
A_2 : P v (-R → Q)

a) Use this table to conduct a truth-table test on those wffs and answer the questions below.

P	Q	R		-	P	→	(	Q	v	R	)	,	P	v	(	-	R	→	Q	)
T	T	T		F	T	***T***		T	T	T			T	***T***		F	T	T	T	
T	T	F		F	T	***T***		T	T	F			T	***T***		T	F	T	T	
T	F	T		F	T	***T***		F	T	T			T	***T***		F	T	T	F	
T	F	F		F	T	***T***		F	F	F			T	***T***		T	F	F	F	
F	T	T		T	F	***T***		T	T	T			F	***T***		F	T	T	T	
F	T	F		T	F	***T***		T	T	F			F	***T***		T	F	T	T	
F	F	T		T	F	***T***		F	T	T			F	***T***		F	T	T	F	
F	F	F		T	F	***F***		F	F	F			F	***F***		T	F	F	F	

b) What, if anything, can you determine about the relations between A_1 and A_2? Circle all and only those that apply (may be more than one).

Cannot be determined	A_1 is contrary to A_2	A_1 is subcontrary to A_2	***A_1 implies A_2***	***A_1 is implied by A_2***
A_1 is equivalent to A_2	A_1 is contradictory to A_2	A_1 is independent of A_2	A_1 is contingent to A_2	A_1 is true to A_2

c) The sequent $A_1 \vdash A_2$ is [*fill in the blank*]. Circle all and only correct answers.

Valid	Invalid	Undetermined	Safe	Complete	True
Inconsistent	Contingent	Unsafe	Incomplete	Subcontrary	Independent

d) The sequent $A_2 \vdash A_1$ is [*fill in the blank*]. Circle all and only correct answers.

Valid	Invalid	Undetermined	Safe	Complete	True
Inconsistent	Contingent	Unsafe	Incomplete	Subcontrary	Independent

e) Classify each of the following as tautologous, contingent, consistent, inconsistent, valid, invalid, complete, safe, or undetermined (may be more than one):

i) $(A_1 \text{ v } - A_2) \rightarrow A_2$ ***contingent, consistent***
ii) $(A_1 \text{ \& } - A_2) \rightarrow A_1$ ***tautologous, consistent***
iii) $A_1 \rightarrow - A_2$ ***contingent , consistent***
iv) $-(A_1 \text{ v } A_2)$ ***contingent , consistent***
v) $- A_1 \leftrightarrow A_2$ ***inconsistent***

2) (**7 points**) Give an example of an invalid sequent, and a valid sequent, *using exactly one propositional variable-type, and at least two connective-types, in each sequent* (not necessarily in each wff). Then fill in the table below.

Is this sequent:	Example of an Invalid Sequent: ***P → P ├ -P***	Example of a Valid Sequent: ***-P ├ P → P***
↓		
Derivable in a safe system of rules?	***No***	***Unknown***
Derivable in a complete system of rules?	***Unknown***	***Yes***
Derivable in a safe and complete system of rules?	***No***	***Yes***
If this sequent is derivable in some system of rules, then that system is:	***Unsafe***	***Unknown***
If this sequent is underivable in some system of rules, then that system is:	***Unknown***	***Incomplete***

3) (**8 points**) Given that 'A' and 'B' represent wffs, state for each of the following whether it is a formula, a wff, a sequent-expression, a symbolic representation of a wff, a symbolic representation of a sequent-expression, or none of the above (may be more than one):
   a) -(-P) ***formula***
   b) -(P & Q) , P ↔ Q ***none of the above (2 formulas/wffs separated by comma)***
   c) (A v B) → (A & B) ***symbolic representation of a wff***
   d) P & Q ├ P → Q ***sequent-expression***
   e) -(-S v Q) ***formula, wff***
   f) -(A & B) , B ├ -A ***symbolic representation of a sequent-expression***

4) (**8 points**) Consider the following assignments of statements to propositional variables:
   P: The Seahawks won the Super Bowl (*false*)
   Q: Tomorrow is Monday (*false*)
   R: Janet had a wardrobe malfunction (*true*)

Using those assignments, translate the following English sentences into wffs of the propositional calculus, and (showing your work) state the truth-value of each resulting wff:
   a) The Seahawks won the Super Bowl only if both tomorrow is Monday and Janet did not have a wardrobe malfunction.

P → (Q & - R)

F ***T*** F F F T ***true***

b) Tomorrow is Monday unless the Seahawks did not win the Super Bowl, if Janet had a wardrobe malfunction.

R → (Q v – P)

T ***T*** F T TF ***true***

c) If it is not the case that both Janet had a wardrobe malfunction and the Seahawks won the Super Bowl, then tomorrow is not Monday.

- (R & P) → - Q

T T F F ***T*** T F ***true***

d) Neither the Seahawks won the Super Bowl nor tomorrow is Monday, just in case Janet had a wardrobe malfunction.

- (P v Q) ↔ R

T F F F ***T*** T ***true***

5) (**8 points**) For each of the following sequents, state whether it is valid, invalid, true, false, complete, incomplete, safe, unsafe, or undetermined (may be more than one).

a) -(Q → S) ├ -Q → S
valid

b) -(P ↔ R) ├ -P & R
invalid

c) P v - Q , Q ├ P
valid

d) -(P & Q), P ↔ Q ├ P
invalid

6) **(12 points)** For each of the sequents in the preceding problem, construct the corresponding conditional and state whether that wff is tautologous, contingent, consistent, inconsistent, valid, invalid, complete, safe, or undetermined (may be more than one).

a) -(Q → S) → (-Q → S) ***tautologous, consistent***

b) -(P ↔ R) → (-P & R) ***contingent, consistent***

c) (P v – Q) → (Q → P) ***tautologous, consistent***

d) -(P & Q) → ((P ↔ Q) → P) ***contingent, consistent***

7) (**8 points**) Going across each row, circle all and only correct answers.

P → Q	Implies		P	Q	-P	-Q
	Is Implied By		P	***Q***	***-P***	-Q
- (P → Q)	Implies		***P***	Q	-P	***-Q***
	Is Implied By		P	Q	-P	-Q

8) (**15 points**) Give an example of a wff for each of the following classifications, *using exactly two different propositional variable-types in each wff*:

Tautologous (A_3): ***(P → P) v Q***

Contingent (A_4): ***P → Q***

Inconsistent (A_5): ***(P & - P) & Q***

Using those wffs labeled as shown above (A_3 tautologous, A_4 contingent, and A_5 inconsistent), state for each of the following whether it is tautologous, contingent, consistent, inconsistent, valid, invalid, complete, safe, or undetermined (may be more than one).

i) $A_3 \rightarrow A_4$ ***contingent , consistent***
ii) A_3 v A_5 ***tautologous, consistent***
iii) $- A_5$ ***tautologous, consistent***
iv) $A_5 \leftrightarrow A_4$ ***contingent , consistent***
v) $- A_3$ & $- A_4$ ***inconsistent***
vi) $A_5 \rightarrow - A_4$ ***tautologous, consistent***

State for each of the following whether it is valid, invalid, true, false, incomplete, unsafe or undetermined (may be more than one).

a) $A_4 \vdash A_4$ ***valid***
b) $\vdash A_4$ v A_5 ***invalid***
c) $- A_5 \vdash - A_3 \rightarrow A_4$ ***valid***
d) $A_4 \vdash A_5 \rightarrow A_3$ ***valid***
e) $A_3 \vdash A_3$ & A_4 ***invalid***
f) $A_4 \vdash A_3$ ***valid***

9) **(12 points)** Conduct a truth-table test on the following sequent: $A_6, A_7 \vdash A_8$
where the metalogical variables are assigned as follows.

A_6: - (Q & S)	A_7: Q → S	A_8: - Q

Q	S		-	(	Q	&	S	)	,	Q	→	S	⊢	-	Q
T	T		F		T	T	T			T	T	T		F	T
T	F		T		T	F	F			T	F	F		F	T
F	T		***T***		F	F	T			F	***T***	T		***T***	F
F	F		***T***		F	F	F			F	***T***	F		***T***	F

a) The sequent $A_6, A_7 \vdash A_8$ is [*fill in the blank*]. Circle all and only correct answers.

Valid	Invalid	Undetermined	Safe	Complete	True
Inconsistent	Contingent	Unsafe	Incomplete	Subcontrary	Independent

Fill in the blanks for the following relations between wffs (may be more than one each):

A_6 _____ ***is subcontrary to*** _____A_7

A_6 _____ ***is implied by*** _____A_8

A_7 _____ ***is implied by*** _____A_8

Construct the corresponding conditional (*which is a wff containing no metalogical variables*) for A_6, $A_7 \vdash A_8$, and state whether it is tautologous, contingent, consistent, inconsistent, valid, invalid, complete, safe, or undetermined (may be more than one).

- (Q & S) → ((Q → S) → -Q) ***tautologous, consistent***

10) **(4 points)** Suppose that A and B are subcontrary wffs. With this in mind, classify each of the following as tautologous, contingent, consistent, inconsistent, valid, invalid, complete, safe, or undetermined (may be more than one).

a) A v B ***tautologous, consistent***

b) -A ⊢ A v B ***valid***