Score	Name	

Box _____

Instructions: Open book, open notes. Do all your work on these pages. When doing derivations in this exam, you may use any of the simple, complex, or derived rules of truth-functional logic listed on the back cover of the course Reader (inside or outside cover). If your derivation is incomplete, you may get partial credit for sketching a sensible derivation strategy.

Turn in your e xam to Kathy Stackhouse in Chem 303 by noon on Thursday, March 30.

1. Indicate whether the following statements are true or false. [22 points]

(a)	Т	F	If one formula does not follow from a second formula, then the negation of the first follows from the second.
(b)	Т	F	You can't make a valid argument invalid by adding premises.
(c)	Т	F	If a formula is formally inconsistent, then it's negation is a logical truth.
(d)	Т	F	If each formula in a set is logically contingent, then the set of formulas taken together is logically consistent.
(e)	Т	F	If a formula is formally consistent, then it is also logically true.
(f)	Т	F	If a formula is logically true, then it is also formally consistent.
(g)	Т	F	If a formula is logically true, then its negation is logically false.
(h)	Т	F	If a formula is formally consistent, then so is its negation.
(i)	Т	F	If a formula is logically true, then so is its disjunction with any other formula.
(j)	Т	F	If a formula is formally consistent, then so is its disjunction with any other formula.
(k)	Т	F	If a formula is logically contingent, then so is its disjunction with any other formula.

2. For each of the following argument forms (a) and (b), produce a derivation that proves that the argument form is valid. [10 pts]

(a) $\underline{A \lor (B \lor C)}$ $(A \lor B) \lor C$

(b)
$$\sim (A \supset B)$$

 $\sim (B \supset C)$
 $D \supset E$

3. Prove that $(P \equiv Q) \supset (\sim (P \& \sim Q) \& \sim (\sim P \& Q))$ is a theorem. [5 points]

4. Circle each of the following truth-value assignments (if any) that show that this argument is invalid. [12 points]

$$\begin{array}{c} \sim (R\&\sim P)\lor\sim T\\ (Q\&(P\equiv R))\supset\sim S\\ \underline{Q\supset S}\\ Q\supset P \end{array}$$

(a)	P Q R S T	- - - -	F T T T
(b)	P Q R S T	- - - -	F T F T
(c)	P Q R S T	- - - -	F T T F F
(d)	P Q R S T	- - - -	F T T T
(e)	P Q R S T	- - - -	F F T T
(f)	P Q R S T	- - - -	T F T T

5. Circle each of the following truth-value assignments (if any) that show that the following group of statements (taken together) is formally consistent. [14 points]

$$\begin{split} P \supset &\sim (Q \ \& \ R) \\ Q \supset &\sim S \\ S \equiv P \\ R \lor &\sim Q \end{split}$$

(a)	P Q R S	- - -	T T T T
(b)	P Q R S	- - -	T T F T
(c)	P Q R S	- - -	T F F T
(d)	P Q R S	- - -	F T T T
(e)	P Q R S	- - -	F T F F
(f)	P Q R S	- - -	F F T F
(g)	P Q R S	- - -	F F F

6. Circle each of the <u>pairs</u> of truth-value assignments (if any) that show that the formula $(A \supset B) \equiv (B \supset A)$ is logically contingent. [12 points]

(a)	A – T, B – T	and	A – T, B – F
(b)	A – T, B – T	and	A – F, B – F
(c)	A – T, B – F	and	A – F, B – T
(d)	A – F, B – F	and	A – F, B – F
(e)	A – F, B – T	and	A – T, B – T
(f)	A – F, B – T	and	A – F, B – F

7. Indicate whether the formula $(P \& Q \& R) \lor (\sim P \& \sim Q \& \sim R)$ is logically true, logically false, or logically contingent, and then prove it using a derivation or a truth-value assignment. N.B. Do <u>not</u> use a truth-table to prove your claim. [5 points]

(a) Circle one: logically true logically false logically contingent

(b) Prove it using derivations or truth-value assignments.

8. <u>Represent</u> the truth-functional form of the following argument, using the phrase book provided. Then <u>derive</u> the conclusion from the premises. [10 points]

Phrase book	G	:	You will get a good grade in Logic.
	Р	:	It is pointless for you to study for Logic.
	F	:	It is fruitless for you to study for Logic.
The argument	t Either you will get a good gra If you will get a good grade i study for Logic. On the other grade, it is fruitless for you to		a will get a good grade in Logic or you will not. I get a good grade in Logic, it is pointless for you to Logic. On the other hand, if you will not get a good s fruitless for you to study for Logic. Hence, for you

(a) Truth-functional form:

(b) Proof of validity or invalidity.

9. The overall form of a theorem might be a conditional, such as $(P\&Q)\supset Q$, or a biconditional, such as $(A\&B)\equiv(B\&A)$, or a disjunction, such as $P\lor\sim P$, or a negation, such as $\sim(P\&\sim P)$. Think of a theorem with the overall form of a <u>conjunction</u> and prove it is a theorem. [5 points]

10. Knaves always lie, knights always tell the truth, and in Translyvania, where everybody is one or the other (but you can't tell which by looking), you encounter two people, one of whom says "He's a knight or I'm a knave." Is the Translyvanian who speaks a knight or a knave? What about the other Translyvanian? [5 points]