Adelaide University

7743 Logic I: Beginning Logic - Exam

November 2001

Time:	Two hours + 10 minutes reading time.
Materials:	The exam is **open book.** You may bring into the exam a copy of *The Power of Logic*, and any notes you require.
Questions:	There are **four pages** of questions, and **twelve** questions.

Question 1. Indicate which of the following arguments are *valid* (V), which are *sound* (S), and which are *strong* (St). For each argument you must answer "yes" or "no" in all three cases (e.g., V – no, S – no, St - yes).

a) All trees are plants. Oaks are trees, so Oaks are plants.

b) Most people are taller than Jill. Therefore, Jill is taller than Jill.

c) All dogs are mammals. Some dogs are not animals. Hence, some mammals are not animals.

d) If whales are fish they are cold blooded. But whales aren't fish, so whales aren't cold blooded.

e) 60% of Australians bet on the Melbourne Cup. Grant is an Australian, so Grant bets on the Melbourne Cup.

(*10 marks*)

Question 2. Identify each of the following arguments as either an *induction by enumeration,* a *statistical syllogism,* an *argument from authority,* an *argument from analogy,* or a *causal argument.* Also indicate whether each argument is *strong* (S) or *weak* (W).

a) The majority of Europeans can speak some English. Magda is a European, so Magda will be able to speak some English.

b) In a tin can factory one in every ten cans is randomly selected and tested for leaks. Approximately 0.5% of these are found to be faulty. Hence, about 0.5% of the cans produced in the factory have leaks.

c) Three times Jason brings water to the boil, and each time it begins boiling at 100°C. Jason concludes that this is the boiling point of water.

d) Bill wonders what makes him drunk. Looking back over his drinking history he notices a pattern—scotch & soda, vodka & soda, and brandy & soda always leave him drunk. Bill infers that soda causes people to get drunk.

(*8 marks*)

Question 3. Identify each of the following statements as true (T) or false (F). Provide a short justification for each of your answers.

a) Strong arguments are true.

b) An unsound argument can have all true premises.

c) Logic determines if an argument's conclusion is true.

d) A valid argument with a true conclusion must have true premises.

(*8 marks*)

Question 4. Translate the following statements into symbols using the scheme provided. (B: Brian was murdered; S: Sam did it; A: Anton has an alibi; T: Teresa has an alibi; E: Egon is a reliable witness; J: Jack is guilty)

a) Brian was murdered, yet Sam didn't do it.

b) It is not the case that neither Anton nor Teresa has an alibi.

c) While Anton has an alibi, Teresa doesn't if Egon is a reliable witness.

d) Unless Egon isn't a reliable witness, either Sam did it or Jack is guilty.

e) Brian was murdered, but only if Egon is a reliable witness and Jack is guilty.

(10 *marks*)

Question 5. Use full truth tables to decide whether the following arguments are valid or invalid. Explain your answer in each case.

a) $\sim A \leftrightarrow B \therefore \sim (A \cdot B)$

b) $[P \rightarrow \sim (Q \cdot R)], Q \cdot \sim R \therefore \sim P$

(*8 marks*)

Question 6. Use the abbreviated truth table method to decide whether the following arguments are valid or invalid. Explain your answer in each case.

a) $H \rightarrow \sim F, \sim (F \vee \sim G) \therefore G \rightarrow H$

b) $P \rightarrow (R \cdot S), \sim P \rightarrow \sim R \therefore P \leftrightarrow (R \cdot S)$

(*8 marks*)

Question 7. Use truth tables to decide whether the following pairs of statements are logically equivalent. Explain your answer in each case.

a) $(A \leftrightarrow B), (\sim A \leftrightarrow \sim B)$

b) $L \rightarrow (M \cdot L), \sim L \vee (M \cdot \sim L)$

(*8 marks*)

Question 8. Annotate the following proofs. Indicate which line(s) each inference is drawn from, and which rule is being applied. (There is no need to write out the proof—just give the line numbers and their annotation.)

a)
1. $(A \cdot B) \rightarrow C$
2. $A \cdot \sim C$ $\quad\quad \therefore \sim C \rightarrow \sim B$
3. $A \rightarrow (B \rightarrow C)$
4. A
5. $B \rightarrow C$
6. $\sim C \rightarrow \sim B$

b)
1. $X \rightarrow Y$
2. $\sim X \vee Z$ $\quad\quad \therefore X \rightarrow (Y \cdot Z)$
3. $\sim X \vee Y$
4. $(\sim X \vee Y) \cdot (\sim X \vee Z)$
5. $\sim X \vee (Y \cdot Z)$
6. $X \rightarrow (Y \cdot Z)$

(*8 marks*)

Question 9. Construct a proof of the following symbolic argument.

1. $M \rightarrow R$
2. $R \rightarrow Q$
3. $\sim Q \cdot S$ $\quad\quad \therefore \sim (S \rightarrow M)$

(*8 marks*)

Question 10. Construct a proof of the following symbolic argument.

1. $(A \vee B) \rightarrow (C \cdot D)$
2. $\sim A \rightarrow (E \rightarrow \sim E)$
3. $\sim C$ $\qquad\qquad \therefore \sim E$

(*8 marks*)

Question 11. Construct a proof of the following symbolic argument using the method of *reductio ad absurdum* (RAA). Remember that anything of the form $p \cdot \sim p$ is a contradiction.

$\sim (K \vee L) \qquad \therefore K \leftrightarrow L$

(*8 marks*)

Question 12. Construct a proof of the following theorem.

$[D \vee (E \cdot F)] \rightarrow [D \vee \sim (\sim E \cdot F)]$

(*8 marks*)

Total (*100 marks*)