

- 1.1. (i) Suppose you know that $(\sim p \wedge q) \vee p$ is false. What can you conclude about the truth values of each of the two variables?
- (ii) Suppose you know that $(p \vee q) \wedge \sim r$ is true. What can you conclude about the truth values of each of the three variables?
- (iii) Suppose you know that $(\sim p \wedge \sim q) \wedge r$ is false. What can you conclude about the truth values of each of the three variables?
- 1.2. For each of the following, write down a truth table for the statement, and determine whether the statement is a tautology, a contradiction, or neither.
- (i) $((p \wedge q) \vee (q \wedge r)) \vee \sim q$
- (ii) $(\sim p \vee q) \vee (p \wedge \sim q)$
- 1.3. (i) Use a truth table to show that $(p \vee q) \wedge \sim p \equiv q \wedge \sim p$.
- (ii) Use a truth table to show that $(p \oplus q) \wedge r \equiv (p \wedge r) \oplus (q \wedge r)$.
- (iii) Use the laws of logical equivalence and the fact that $p \oplus q \equiv (p \vee q) \wedge \sim (p \wedge q)$, to show that $(p \oplus q) \wedge r \equiv (p \wedge r) \oplus (q \wedge r)$.
- 1.4. (i) Use the laws of logical equivalence to show that $p \wedge q \equiv \sim (\sim p \vee \sim q)$.
- (ii) Use the laws of logical equivalence to show that $\sim (p \vee \sim q) \vee (\sim p \wedge \sim q) \equiv \sim p$.
- 1.5. For each of the following sentences, use De Morgan's laws to write an equivalent sentence.
- (i) It is not true that I am studying Computer Science and I am studying Engineering.
- (ii) I am not going to the movies this weekend or I am not going swimming this weekend.
- 1.6. For each of the following, write down a truth table for the statement, and determine whether the statement is a tautology, a contradiction, or neither.
- (i) $(\sim p \wedge (p \rightarrow q)) \rightarrow \sim q$
- (ii) $(p \rightarrow (q \vee r)) \longleftrightarrow ((p \wedge \sim q) \rightarrow r)$
- 1.7. Write each of the following statements in the form "if ... then ...".
- (a) A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.
- (b) Jane gets seasick whenever she is on a boat.
- Now negate the following two statements.
- (c) If it rains, then Sue takes her umbrella.
- (d) The cakes burn if the oven temperature is too high.

Here are two **puzzles** that you can think about during week 2; they are related to the first lecture. If you're stuck, I might drop some hints on a later tutorial sheet!

- A.** Suppose each point of the plane is coloured either red or blue. Show that the four vertices of some rectangle are all of the same colour.

Hint: Draw three parallel lines. What do you notice when you draw a common perpendicular to them?

- B.** Suppose you label 10 points on a circle randomly with the numbers $1, 2, 3, \dots, 10$, with each number used exactly once. Show that there are always 3 consecutive points whose labels sum to strictly more than 16.

Extra practice questions from the textbook (Solutions at the back of the book.)

Epp 5th ed.:

Section 2.1, pp. 51–53: Questions 6, 8ad, 10ac, 11, 12, 14, 16, 25, 27, 32, 34, 36, 40, 41, 48, 50.

Section 2.2, pp. 63–65: Questions 1, 3, 5, 7, 9, 12, 16, 19, 29, 32, 34, 40, 42, 44, 47, 49.

Epp 4th ed.:

Section 2.1, pp. 37–38: Questions 6, 8ad, 10ac, 11, 12, 14, 16, 25, 27, 32, 34, 36, 40, 41, 48, 50.

Section 2.2, pp. 49–50: Questions 1, 3, 5, 7, 9, 12, 16, 19, 29, 32, 34, 40, 42, 44, 47, 49.