COMS10014 Class Test 1

Instructions

1. Write your 7-digit student number (from the back of your UCard) in the provided box of your answer sheet, one digit per box. Do not write your name or any other identifying information.
2. You must complete your answers on the provided answer sheet.
3. You must use pencil for your answer sheet. If you make a mistake, use your eraser.
4. Only your answers will be marked, not your workings. You may use the blank paper provided for your workings, but this will not be marked.
5. You may use a non-programmable calculator and up to one side A4 of handwritten notes.

Completing the Answer Sheet

	✓ **Correct**	✗ **Incorrect**
Where a question asks for a cross, it must fit entirely within a green box.		
Use an eraser if you need to change your answer.		
Make crosses and no other symbols.		

Not following these rules immediately gives zero marks for the question.

Do not turn over until you are told to start the test.

Question 1 **(6 marks)**

Classify all of the following strings, using infix notation, as exactly one of:

- **TERM**: a valid logical term (string), also known as a logical formula.
- **STMT**: a valid logical statement (string), but not a term.
- **NONE**: none of the above.

The strings are:

1. $x \vDash x \vee y$
2. $(x \vee y) \rightarrow (x \wedge y)$
3. $(x \equiv y) \rightarrow x$
4. $(x \neg y) \wedge (x \vee y)$
5. $x \vee y \equiv y \vee x$
6. $(x \wedge y) \vdash x \vdash (x \vee y)$

Enter your answer by making exactly one cross in each column of the table on your answer sheet. For example, if you think that 2. is a valid term (string), then make a cross in the TERM row in column 2.

Question 2 **(8 marks)**

Match all statements 1.–4. with the statement from A.–D. that is semantically equivalent. Each of the numbered statements is equivalent to exactly one of the lettered statements (no two of the lettered statements are equivalent).

1.	$(p \uparrow p) \uparrow (q \uparrow q)$	A.	$p \vee q$
2.	$(p \uparrow p) \downarrow (q \uparrow q)$	B.	$p \wedge q$
3.	$(p \downarrow q) \downarrow (p \downarrow q)$	C.	$\neg(p \vee q)$
4.	$(p \downarrow q) \uparrow (p \downarrow q)$	D.	$\neg(p \wedge q)$

Enter your answer by making exactly one cross in each column of the table on your answer sheet. For example, if you think that 2. matches B., make a cross in column 2. in the B. row.

Question 3 **(12 marks)**

Consider the following propositions, over the domain of all (fictional) animals. The words *Snark, Boojum* and *Jubjub* are made-up and have no English meaning in this question.

P. Every *Boojum* is also a *Snark*.
Q. If an animal is both a *Snark* and a *Jubjub*, then it is not a *Boojum*.

Mark the following statements as true or false:

1. The contrapositive of P is "Every *Snark* is also a *Boojum*."
2. The converse of P is equivalent to P.
3. If the negation of the converse of Q is true, then so is Q.
4. The inverse of Q is "An animal that is not both a *Snark* and a *Jubjub*, is a *Boojum*."
5. The negation of the contrapositive of Q is equivalent to Q.
6. The converse of Q is "An animal that is both a *Snark* and a *Jubjub* is also a *Boojum*."

For each statement, make a cross completely within either the T box or the F box.

Question 4 **(12 marks)**

Mark the following statements about logic as true or false.

1. $P \vDash Q$ means the same as "$P \to Q$ is a tautology".
2. In propositional logic, $P \vDash Q$ holds if and only if $P \vdash Q$ holds (using the rules presented in the lecture notes).
3. $P \leftrightarrow Q \vDash P \to Q$.
4. $P \to Q \equiv \neg Q \vee P$.
5. The negation of a contingency is a contradiction.
6. If $P \vDash Q$ and $Q \vDash R$ then $P \vDash R$.

For each statement, make a cross completely within either the T box or the F box.

Question 5 **(6 marks)**

Complete the truth table for the following term, given in RPN notation.

$$p\ r\ \neg\ \wedge\ q\ p\ \to\ \wedge$$

This is the end of the class test.