202409 Quiz 1
Math 122 A04
Instructor: Jonathan Noel

First name (please write as legibly as possible within the boxes)

| S | O | L | U | T | I | O | N | S | | | | | | | | | |

Last name

Student ID number (V Number)

Do not open the booklet before you are told to

Date and Time: Tuesday, September 17, 2024 at 1:55pm.

Instructions: There are 3 pages and 6 questions. There are 15 marks available. The time limit is 25 minutes. Math and Stats standard calculators are allowed. Except when indicated, it is necessary to show clearly organized work in order to receive full or partial credit. Use the back of the sheet for rough work.

True/False Instructions: Question 1 consists of 8 true/false questions labelled **TF 1** to **TF 8**. The last page of your test booklet is a bubble sheet for answering them. You may detach the back page from the rest of the test if you wish. Only fill in a bubble for questions 1-8 on the bubble sheet. When making your selection, **True is A** and **False is B**. Do not select C, D or E. If you want to change your answer after filling in a bubble, then please erase your previous answer or write something on the sheet to try to make your final selection as clear as possible.

Do your rough work here. This will not be marked.

1. [4] Use the bubble sheet provided on the last page of the test booklet to indicate whether each statement is **True (A)** or **False (B)**.

   [**TF 1**] If $\neg p \to \neg q$ is true, then $p \to q$ is false. **F**

   [**TF 2**] If $p \leftrightarrow q$ is false, then $p \to q$ is false. **F**

   [**TF 3**] There are truth values for p, q and r such that $p \to (q \wedge \neg r)$ is false and $q \to r$ is false. **F**

   [**TF 4**] If $p \wedge \neg q$ is a tautology, then $p \leftrightarrow q$ is a contradiction. **T**

   [**TF 5**] The contrapositive of $p \to \neg q$ is $\neg q \to p$. **F**

   [**TF 6**] $(5 = 7) \to (5 = 5)$ **T**

   [**TF 7**] The statement $p \wedge (\neg p \to p)$ is a contradiction. **F**

   [**TF 8**] $p \wedge q$ is logically equivalent to $\neg(p \to \neg q)$ **T**

2. [3] For the statement "*If I don't drink coffee, then I will be tired.*", write the following in English:

   Converse:

   If I will be tired, then I don't drink coffee.

   Contrapositive:

   If I won't be tired, then I drink coffee

   Negation:

   I don't drink coffee and I will not be tired.

3. [3] Use any method to determine whether $q \wedge ((p \leftrightarrow \neg q) \to q)$ is logically equivalent to q. Explain your reasoning.

p	q	$\neg q$	$p \leftrightarrow \neg q$	$(p \leftrightarrow \neg q) \to q$	$q \wedge ((p \leftrightarrow \neg q) \to q)$
0	0	1	0	1	0
0	1	0	1	1	1
1	0	1	1	0	0
1	1	0	0	1	1

Same, therefore LE

Do your rough work here. This will not be marked.

4. [1] Write the statement "*Whenever I go outside, it rains*" in English in the form "if *hypothesis*, then *conclusion*."

$$\text{If I go outside, then it rains.}$$

5. Let g, s and t be the following statements:

g : Gymnastics is difficult

s : Skiing is fun

t : Tetris is fun

Write each of the following statements in symbolic form using only ~~p, q, r~~ g, s, t, $\neg, \wedge, \vee, \rightarrow, \leftrightarrow$ and brackets.

(a) [1] If gymnastics is difficult, then skiing is fun or Tetris is not fun.

$$g \rightarrow (s \vee \neg t)$$

(b) [1] Exactly one of skiing or Tetris is fun.

$$s \leftrightarrow \neg t \qquad \left(\begin{array}{l}\text{you could also do} \\ (s \wedge \neg t) \vee (\neg s \wedge t)\end{array}\right)$$

6. [2] Suppose that $(p \wedge q) \leftrightarrow p$ is false. Find all possible combinations of truth values for which the statement $p \rightarrow (q \wedge r)$ is true. Explain your reasoning.

If $(p \wedge q) \leftrightarrow p$ is false, then $p \wedge q$ and p have different truth values. If p is false, then $p \wedge q$ is false. So, p must be true and q must be false for $(p \wedge q) \leftrightarrow p$ to be false.

But then $q \wedge r$ is false and, since p is true, $p \rightarrow (q \wedge r)$ is false.

So, there are <u>none</u>.

Do your rough work here. This will not be marked.