Full Name:
Student Number:

TOTAL POINTS: /10

Trent University MATH 2600 - Discrete Structures
Instructor: Aras Erzurumluoğlu

Assignment 1 (due 3:00 pm on Jan 23, 2020 Thursday)

READ ME: Please print this page, write down your name and student number, and attach this page as the cover page to your homework solutions.

When attempting the problems you are allowed to consult any resources such as the lecture notes, textbooks, the internet, etc. In particular, you are encouraged to collaborate and brainstorm with your classmates. However, you are not allowed to copy each other's work (not even partially!).

Each student is required to **submit** a separate solution set by the deadline **to the assignment box in the Mathematics department that has my name on it.**

You are expected to write your solutions in full detail and using a precise mathematical language. You will lose points for imprecise solutions.

Late assignments will not be accepted except for extreme situations.

Problem 1) (2 points): Find a proposition consisting of p, q, r and the logical connectives $\neg$ and $\vee$ that is equivalent to $\neg(p \to q) \to r$. Show all your work.

Problem 2) (2 points): Two propositions p and q joined by the "exclusive or" operator, that is $p \oplus q$, has the truth value T (true) if and only if exactly one of p and q has truth value T.

Let p, q, r be arbitrary propositions. Show that $(p \oplus q) \oplus r \cong p \oplus (q \oplus r)$.

Problem 3) (2 points): On the island of Knights and Knaves we have three people A, B and C. (The island must be known for its inhabitants' very short names.)

A says: We are all knaves.

B says: Only one of us is a knave.

Using an approach similar to the one in the notes, determine if A, B and C are each a knight or a knave. (The problem might have no solutions, one solution, or many solutions.)

Problem 4) (1 point): Translate the given statement into propositional logic using the propositions provided.

"You can graduate only if you have completed the requirements of your major and you have finished all the paperwork and you do not have an overdue library book."

Express your answer in terms of

g: "You can graduate",

m: "You have finished all the paperwork",

r: "You have completed the requirements of your major", and

b: "You have an overdue library book".

Problem 5) (3 points): Use the rules of inference together with basic logical equivalences to show that the following argument is valid. Name the rule you use at each step.

$w \vee \neg z \rightarrow r$
$s \vee \neg w$
$\neg t$
$z \rightarrow t$
$\neg z \wedge r \rightarrow \neg s$

$\therefore \neg w$