

## Homework 2: Propositional Logic

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**Submission policy.** Submit your answers on paper **before** the class starts on **Monday**, Feb. 3, 2020. No late submissions accepted.

1. Handwritten answers are fine but please make sure they are readable.
2. Your name should be printed at the very top of the document.

**Administration.** This assignment will be graded by GTA.

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### Practice Questions – Do NOT submit these.

Textbook questions 2.1, 2.3 (a) and (b), 2.4, 2.5, 2.6, 2.7 (a) and (b), 2.8, 2.11, 2.14, 2.15 2.16. 2.5, 2.6, 2.7(b), 2.8, 2.11, 2.14, 2.15, 3.1

### Question that will be graded. Total Points 100.

#### Exercise 1. Part (a) [50 points].

Prove the following equivalence by substitution, i.e., use known logical equivalences to show that  $(p \rightarrow r) \rightarrow ((q \rightarrow r) \rightarrow ((p \vee q) \rightarrow r))$  is equivalent to TRUE. *You must start from the statement  $(p \rightarrow r) \rightarrow ((q \rightarrow r) \rightarrow ((p \vee q) \rightarrow r))$ .* Justify each step with the name of the corresponding logical equivalence being used. For full credit, *do not skip steps!*

$$(p \rightarrow r) \rightarrow ((q \rightarrow r) \rightarrow ((p \vee q) \rightarrow r)) \equiv \text{TRUE}$$

#### Part (b) [50 points].

(i) (25 points) Prove that the Method of Affirming (Modus Ponens) is sound using truth tables.

(ii) (25 points) Prove that the Method of Denying (Modus Tollens) is sound using truth tables.