# 15-151 Mathematical Foundations for CS – EXCEL

Topic: **Intro, Ice breaker, Logic, Sets, Functions**
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Session Date: **Mon 16 Sep 19**
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Services available: Supplemental Instruction (SI), Academic Counseling in Study Skills, Individual & Walk-in Tutoring

## *I. Two Lies and a Truth*

Instructions: Each person writes down three facts about themselves, two of which are lies. Then each person takes turns reading their list aloud and the rest of the group writes down the one they think is the truth. When all are done reading the lists aloud, the first person reads their list again and identifies the truth. The group sees how well they did.

## *II. Fill in the Blanks*

- A propositional variable may be assigned a _____ value, either _____ or _____.
- A propositional formula is an expression that is either a propositional variable, or is built up from simpler propositional formulae using _____.
- For each of the following logical operations, write the operator symbol and its definition.
  - Conjunction: _____, _____
  - Disjunction: _____, _____
  - Implication: _____, _____
  - Biconditional: _____, _____
  - Negation: _____, _____

- The converse of a proposition of the form $p \Rightarrow q$ is the proposition _____.
- The contrapositive of a proposition of the form $p \Rightarrow q$ is the proposition _____.
- A contradiction is a proposition known or assumed to be _____, denoted as _____.
- Write a plain English statement with the universal quantifier, then argue its truth value.

  _____
- Write a plain English statement with the existential quantifier, then argue its truth value.

  _____
- Write a plain English statement with the unique existential quantifier, then argue its truth value.

  _____
- Write the de Morgan's law for the following
  - Logical operation – conjunction: _____
  - Logical operation – disjunction: _____
  - Universal quantifier: _____
  - Existential quantifier: _____
- A tautology is a proposition or logical formula that is _____, no matter

  _____.
- Let $a, b \in \mathbb{R}$. Define the following intervals using set builder notation.
  - $(a, b)$ _____
  - $(a, b]$ _____
  - $[a, b]$ _____
  - $[a, \infty)$ _____
- Let $X$ be a set. A subset of $X$ is a set $U$ such that _____.
- Let $X, Y$ be sets. Then $X = Y$ if and only if _____.
- The empty set is the set with _____, denoted as _____.
- Define the following set operations using set builder notation.
  - Intersection: _____
  - Union: _____
  - Relative complement: _____
  - Cartesian product: _____
- Let $X$ be a set. The power set of $X$ is _____, denoted as _____.