CECS 228 Group Assignment 3: Predicate Logic

September 29, 2021

Instructions

Working together

Pair up with another student to solve both problems below. You are only allowed to discuss the problems with your partner and the lab instructor(s). Use of course notes, textbook, and lecture recordings is permitted, but no other online resources or outside communication is allowed. Each of you is responsible for authoring a (handwritten) solution to ONE of the problems. For example, if you author the solution to Problem A, then your partner authors the B solution.

Submitting your work

Submit ONE solution to the ONE problem you were assigned. Make sure you provide your name and SID as well as your partner's name in the upper-right corner of your solution, since both of you will receive points for each of the solutions. Upload your solution in a single file to the appropriate drop box before the end of class. Showing sufficient work is necessary for receiving maximum points.

Late submissions

Should you submit after the dropbox deadline, solutions received no later than 10 minutes after the deadline will lose 10% of the earned points. Solutions received after 10 minutes but less than 30 minutes after deadline will lose 50% of the earned points. All other late submissions will not be graded.
Bottom line: make it a goal to submit no later than 5 minutes before the drop-box deadline.

Problems

Since starting college, five students Alice, Bob, Carlos, Duyen, and Erica have been living off of three kinds of foods: pizza, quesadilla, and ravioli. Let variable x have as its domain the set consisting of these five students. Moreover, let $p(x)$ be the predicate function that evaluates to 1 iff student x eats pizza. Predicate functions $q(x)$ and $r(x)$ (for quesadilla and ravioli, respectively) are defined similarly.

A. Use the above names, variables, and functions to translate each of the following statements. (2 pts each)

   1. Everyone who eats pizza also eats ravioli.
   2. If Duyen eats ravioli and someone eats quesadillas, then Bob does not eat ravioli.
   3. Either Alice or Duyen eat ravioli, but not both.
   4. Erica either eats quesadillas or she does not eat ravioli. (Hint: assume inclusive OR).

B. Provide a layperson translation for each of the following predicate-logic formulas. (2 pts each)

   1. $\forall x(q(x) \rightarrow (r(x) \leftrightarrow r(\text{Duyen})))$
   2. $r(\text{Carlos}) \rightarrow (r(\text{Duyen}) \vee r(\text{Erica}))$
   3. $(p(\text{Carlos}) \wedge p(\text{Bob})) \vee (p(\text{Erica}) \wedge p(\text{Alice}))$

C. Use the clues from Problems A and B to determine which students eat ravioli. Defend your answer by referring to the above clues. (11 points)