# Semantic Web (CSE632)
# Winter 2020
## Assignment 2

**Instructions**

1. Assignment is not a group activity. Each student has to work on it by himself/herself and submit the assignment.
2. Plagiarism check and policies will be strictly enforced. Students can be selected at random for a "viva" on the assignment and if the responses are not satisfactory, they will get a 0 in the assignment.
3. Submit the answers in the form of a pdf. Include the code in the pdf as well as separate python files. Provide comments in the code and document every step of your code (except variable assignment).

**Questions** **Max points: 50**

1. Find the disjunctive normal form for the formula $((A \wedge B) \Rightarrow C) \Rightarrow ((A \Rightarrow C) \vee (B \Rightarrow C))$
   a. using a truth table **5 pt**
   b. Write a Python program that can take as input any given propositional formula and puts out i) the corresponding truth table, and ii) the corresponding disjunctive normal form of the given formula. You can use the following symbols as logical connectives along with the parenthesis.
      i. + for disjunction **10 pt**
      ii. . for conjunction
      iii. ~ for negation
      iv. * for implication
      v. == for bi-implication

2. Check the validity of the following formulas using the tableau algorithm
   a. $(\exists x\,(B(x) \wedge \forall y\,(C(y) \Rightarrow (S(x,y) \Leftrightarrow \neg S(y,y))))) \Rightarrow \exists x\,(B(x) \wedge \neg C(x))$ **5 pt**
   b. $\exists x\,(A(x) \Rightarrow B(x)) \Leftrightarrow (\forall x\,A(x) \Rightarrow \exists x\,B(x))$ **5 pt**
   c. $(\exists x\,A(x) \Rightarrow \exists x\,B(x)) \Rightarrow (\forall x\,(A(x) \Rightarrow B(x)))$ **5 pt**

3. Angelo, Bruno and Carlo are three students that took the Logic exam. Let's consider a propositional language where A is "Aldo passed the exam", B "Bruno passed the exam", and C is "Carlo passed the exam". Using only these three propositions, formalize the following sentences into propositional logic formulas **5 pt**
   a. Carlo is the only one passing the exam
   b. Aldo is the only one not passing the exam
   c. Only one, among Aldo, Bruno and Carlo, passed the exam
   d. Exactly two, among Aldo, Bruno and Carlo passed the exam
   e. At least two among Aldo, Bruno and Carlo passed the exam

4. Write a Python program to implement the tableau algorithm for propositional logic to check the logical consequence of the given two formulas. You can use the symbols given in Q1 (b). **15 pt**
   Test case: Is $(A \Rightarrow B) \Rightarrow (A \Rightarrow C)$ a logical consequence of $A \Rightarrow (B \Rightarrow C)$?
   Expected Input: (A * B) * (A * C), A * (B * C)
   Expected Output: Yes