**Lab 05 Rules of Inference**

**Objective**

Solving exercises from the textbook in chapter 1.6 and 1.7(partial)

**Current Lab Learning Outcomes (LLO)**

By completion of the lab, the students should be able to:

1. use rules of inference to build the arguments.

2. determine the validity of the arguments using rules of inference

3. They will be able to solve shorter/easier or longer / harder problems given in the textbook.

**Lab Requirements**

Students allowed using their lecture notes in the lab in order to solve the exercises.

**Lab Assessment**

1- Divide students to groups and let them to solve the given example.

2- Discuss the answers with the groups and write on board the optimal solution

1. Use rules of inference to show that the hypotheses “If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on,” “If the sailing race is held, then the trophy will be awarded,” and “The trophy was not awarded” imply the conclusion “It rained
2. Use rules of inference to show that if ∀*x(P(x)* →*(Q(x)* ∧ *S(x)))* and ∀*x(P(x)* ∧ *R(x))* are true, then ∀*x(R(x)* ∧ *S(x))* is true.
3. Use rules of inference to show that if ∀*x(P(x)* ∨ *Q(x))*, ∀*x(*￢*Q(x)* ∨ *S(x))*, ∀*x(R(x)*→￢*S(x))*, and ∃*x*￢*P(x)* are true, then ∃*x*￢*R(x)* is true.
4. For each of these arguments, explain which rules of inference are used for each step.

**a)** “Doug, a student in this class, knows how to write programs in JAVA. Everyone who knows how to write programs in JAVA can get a high-paying job. Therefore, someone in this class can get a high-paying job.”

**b)** “Somebody in this class enjoys whale watching. Every person who enjoys whale watching cares about ocean pollution. Therefore, there is a person in this class who cares about ocean pollution.”

**c)** “Each of the 93 students in this class owns a personal computer. Everyone who owns a personal computer can use a word processing program. Therefore, Zeke, a student in this class, can use a word processing program.”

**d)** “Everyone in New Jersey lives within 50 miles of the ocean. Someone in New Jersey has never seen the ocean. Therefore, someone who lives within 50 miles of the ocean has never seen the ocean.”

1. Show that the premises “If you send me an e-mail message, then I will finish writing the program,” “If you do not send me an e-mail message, then I will go to sleep early,” and “If I go to sleep early, then I will wake up feeling refreshed” lead to the conclusion “If I do not finish writing the program, then I will wake up feeling refreshed.”
2. Use a formal proof to prove that the following premises:

(r∧¬s)∨(q∧¬s)

¬s→((p∧r)→u)

u→(s∧¬t)

lead to the conclusion:  p→q

1. Use a direct proof to show that the sum of two even integers is even
2. Use a direct proof to show that every odd integer is the difference of two squares.
3. Use a direct proof to show that the product of two rational numbers is rational
4. Use a proof by contraposition to show that if *x* + *y* ≥2, where *x,y* are real numbers, then *x* ≥1 or *y* ≥ 1.