Quiz 1 (*1 Aug, Marks: 6, Duration: 45 mins*) **COL750, Jul-Dec 2024**

Name: **Entry No.:**

1. **[1 marks]** Suppose that the statement $p \to \neg q$ is false. Find all combinations of truth values of r and s for which $(\neg q \to r) \wedge (\neg p \vee s)$ is true. Show the steps that you took to arrive at the answer.

2. **[0.5*4 = 2 marks]** Use the following predicates:

$$\begin{array}{rl} R(x,y): & x \text{ respects } y \\ A(x,z): & x \text{ attended } z \\ P(y): & y \text{ is a professor} \\ S(x): & x \text{ is a student} \\ L(z): & z \text{ is a lecture} \end{array}$$

and the constant symbol:

$$h: \quad \text{Hritik}$$

to translate the following into predicate logic.

(a) Hritik respects every professor.

(b) No student attended every lecture.

(c) No lecture was attended by every student.

(d) No lecture was attended by any student.

3. **[1 marks]** Suppose that P and Q are propositional logic formulas such that $P \vDash Q$. Show that if P and Q have no variables in common then either P is unsatisfiable or Q is valid.

4. **[2 marks]** Let p and q be atomic propositions, and ϕ_1 and ϕ_2 be propositional logic formulas on p and q defined as follows:

- $\phi_1 = (p \to \neg\phi_2)$
- $\phi_2 = (q \to \neg\phi_1)$

Show that there are exactly two pairs of propositional logic formulas (ϕ_1, ϕ_2) which satisfy the above definitions.