

Name of the Student: _____

There are 2 questions in the exam. You have 25 minutes to finish the exam.

Question 1 (50%)

Given the following information:

If wisdom and patience are useful, then there is hope.

If there is hope, there is trouble.

Patience is useful and there is no trouble.

What about wisdom, can we decide whether it is useful or not? Motivate your answer by constructing a truth-tree.

Question 2 (50%)

Any binary relation $R \subseteq A \times B$ has an inverse $R^{-1} \subseteq B \times A$ defined as:

$$R^{-1} = \{(b, a) \mid (a, b) \in R\}$$

Given two relations Q and R , the composition of them, $Q \circ R$ is the relation,

$$\{(a, c) \mid (a, b) \in R \text{ and } (b, c) \in Q \text{ for some } b\}$$

Let R_1 be the truth-function for ‘ \wedge ’ of propositional logic; and R_2 be the truth-function for ‘ \vee ’ of propositional logic. Give the set $R_1^{-1} \circ R_2$ (composition of the inverse of R_1 with R_2).