**Intelligent Systems**

**Exercise 11. Reasoning in   
 Propositional Logic**



# Exercise description

The objective of this exercise is to apply the concepts of reasoning in Propositional Logic.

**Team members**

Write the student id, name, and campus of each member in a different line.

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**Reasoning in Propositional Logic:**

1. Are the statements and logically equivalent? Explain your answer including a truth table.

**Yes, the statements and are logically equivalent**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | (QvR) | **P -> (QvR)** | P -> Q | P->R | **(P -> Q) v (P -> R)** |
| 1 | 1 | 1 | 1 | **1** | 1 | 1 | **1** |
| 1 | 1 | 0 | 1 | **1** | 1 | 0 | **1** |
| 1 | 0 | 1 | 1 | **1** | 0 | 1 | **1** |
| 1 | 0 | 0 | 0 | **0** | 0 | 0 | **0** |
| 0 | 1 | 1 | 1 | **1** | 1 | 1 | **1** |
| 0 | 1 | 0 | 1 | **1** | 1 | 1 | **1** |
| 0 | 0 | 1 | 1 | **1** | 1 | 1 | **1** |
| 0 | 0 | 0 | 0 | **1** | 1 | 1 | **1** |

1. Use the truth table method to verify whether the next logical consequence is correct:

**Yes, the logical consequence is correct because when every premise is true, the conclusion is also true.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **P** | **Q** | **P -> Q** | **Q -> P** | **P v Q** | **P ^ Q** |
| **1** | **1** | 1 | 1 | 1 | 1 |
| **1** | **0** | 0 | 1 | 1 | 0 |
| **0** | **1** | 1 | 0 | 1 | 0 |
| **0** | **0** | 1 | 1 | 0 | 0 |

1. Reduce the following formula to its clausal form:
2. Remove implications and Biconditionals

(p -> q) ^ (q -> p) -> r

~((~p v q) ^ (~q v p)) v r

1. Introduce negations

(~(~p v q) v ~(~q v p))v r

((p ^ ~q) v (q ^ ~p) )v r

1. Distribute disjunctions over conjuctions

((p ^ ~q) v r) ^ ((q ^ ~p) v r)

(p v r) ^ (~q v r) ^ (q v r) ^ (~p v r)

1. Clauses:

C1: p v r

C2: ~q v r

C3: q v r

C4: ~p v r

1. Propositional reasoning by resolution:

Consider the following relationships among concepts:

"persons who consume neither meat nor fish food are vegetarians;"

"vegans consume no animal food nor milk products,"

"to consume meat is to consume animal food,"

"to consume fish food is to consume animal food."

Do the above relationships among concepts imply that vegans are vegetarians?

1. Define a vocabulary of positive propositions.

M: people who consume meat

F: people who consume fish food

V: people who are vegetarians

B: people who are vegans

A: people who consume animal food

L: people who consume milk products

1. Translate the above claims into a set of propositional formulas.
   1. (~M ^ ~F) -> V
   2. B -> (~A ^ ~L)
   3. M -> A
   4. F -> A
2. Reduce the translated claims to their clausal forms.
   1. ~(~M ^ ~ F) v V … (M v F) v V
   2. ~B v (~A ^ ~L) … (~B v ~A) ^ (~B v ~L)
      1. ~B v ~A
      2. ~B v ~L
   3. ~M v A
   4. ~F v A
3. Using resolution by refutation to check if the implication is proved.

