**Logic and AI**

**1/13/2022**

Logic: The Science of Reasoning

Reasoning: Method to find the truth

2 types of Logic: Classic Logic (Prepositional Logic), Fuzzy Logic

Proposition: A statement that is either T or F (True Value) but not both

|  |  |
| --- | --- |
| Statement | Is it a Proposition |
| Is it Hot | Proposition |
| I am a student | Proposition |
| What time is it? | Not Proposition |
| Tulsa is the Capitol of Ok | Proposition |
| 1 + 1 = 3 | Proposition |
| X – 2 = 7 | Not Proposition |
| 23 > 6 | Proposition |
| 2n > 6 | Not Proposition |

**Operations on Prepositions (Connectives)**

1. AND ∧ P∧Q (Conjunction)
2. OR V PvQ (Disjunction)
3. NOT ¬ or ‘ ¬P or P’
4. Implication 🡺 if - then – (P is the antecedent, Q is the consequence)

P 🡺 Q (IF P then Q)

1. Equilvalence 🡸🡺 (if and only if)

P🡸🡺Q (P if and only if Q)

Truth Table

AND

|  |  |  |
| --- | --- | --- |
| P | Q | P∧Q |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | P∧Q | Q∧R | P∧R | P∧Q∧R |
| T | T | T | T | T | T | T |
| T | T | F | T | F | F | F |
| T | F | T | F | F | T | F |
| T | F | F | F | F | F | F |
| F | T | T | F | T | F | F |
| F | T | F | F | F | F | F |
| F | F | T | F | F | F | F |
| F | F | F | F | F | F | F |

OR

|  |  |  |
| --- | --- | --- |
| P | Q | PvQ |
| T | T | T |
| T | F | T |
| F | T | T |
| F | F | F |

NOT

|  |  |  |  |
| --- | --- | --- | --- |
| P | Q | >P | >Q |
| T | T | F | F |
| T | F | F | T |
| F | T | T | F |
| F | F | T | T |

Implication

|  |  |  |  |
| --- | --- | --- | --- |
| P | Q | P🡺Q |  |
| T | T | T🡺T | T |
| T | F | T🡺F | F |
| F | T | F🡺T | T |
| F | F | F🡺F | T |

Equivalence

|  |  |  |
| --- | --- | --- |
| P | Q | P🡸🡺Q |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | T |

**1/18/2022**

Example of 🡪

1. IF the sky is cloudy then it will rain

WFF: Well Formed Formula

1. Any proposition is a WFF
2. If null set is a Wff, then null set` is a WFF
3. If P & Q are WFFs then so are P ∧ Q, P V Q, P 🡪 Q, P 🡨🡪 Q

Example: Let P, Q, R be prepositions

P: You habe the flu

Q: You miss the final exam

R: You pass the course

Express eah of these prepositions below as English sentences

1. P 🡪 Q

If you have the flu then you miss the final exam

1. Q 🡪 R`

If you miss the final exam then you do not pass the course

1. (P ∧ Q) V (`Q ∧ R)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | Q` | P ∧ Q | Q` ∧ R | (P∧Q) V (Q`∧R) |
| T | T | T | F | T | F | T |
| T | T | F | F | T | F | T |
| T | F | T | T | F | T | T |
| T | F | F | T | F | F | F |
| F | T | T | F | F | F | F |
| F | T | F | F | F | F | F |
| F | F | T | T | F | T | T |
| F | F | F | T | F | F | F |

**1/20/2022**

Keywords

Not: un, im, in

And: and, but, however

Or: or,

Implication 🡪: if – then -, implies, only if

Equivalent 🡨🡪: if and only if, when and only when

Either joe or bill or both will play badly at the tournament but if joe plays badly then there will be no victory party

P: Joe will play badly

Q: Bill will play badly

R: There will be a victory party

(P V Q) ∧ (P 🡪 R`) = E

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | R` | PVQ | P🡪R` | E |
| T | T | T | F | T | F | F |
| T | T | F | T | T | T | T |
| T | F | T | F | T | F | F |
| T | F | F | T | T | T | T |
| F | T | T | F | T | T | T |
| F | T | F | T | T | T | T |
| F | F | T | F | F | T | F |
| F | F | F | T | F | T | F |

Special Truth Tables

Contradictions: Compound prepositions whose truth table shows them to be false under all combinations

Tautology: Compound prepositions whose truth table shows them to be true under all combinations

**1/25/2022**

**1/27/2022**

De Morgan’s Laws

(P ∧ Q)` ≡ P` V Q`

(P V Q)` ≡ P` ∧ Q`

Text, letter

Description automatically generated

Text

Description automatically generated with low confidenceTable

Description automatically generated with medium confidenceText

Description automatically generated

Text

Description automatically generated

**2/1/22**

P 🡪 Q = (PVQ)` or Q` 🡪 P`

**2/8/2022**

Boolean Algebra

AND = \* or nothing

OR = +