Date
Page

12th November, 2024. Tuesday Laboratory - 7

Entailment is a deduction or implication which follows or is in accordance and accuracy with logic

To derive these implications, rules of inference and logical equivalences are used (to derive relationships) together with rules of truth functional values.

① Modus Ponens (MP)

$P \rightarrow Q$ (If P then Q)

P is true, then Q is true

Example: P ⇒ It is raining

Q = Playground wet

If it is raining then playground will be wet.

② Modus Tollens (MT)

$P \rightarrow Q$, $\neg Q$ Conclusion $\neg P$

(If P then Q), (Q is false)

If it is raining, the ground will be wet, ground is not wet

It is not raining.

③ Hypothetical Syllogism (HS)

$P \rightarrow Q$, $Q \rightarrow R \therefore P \rightarrow R$

R = Grass will grow

If it is raining, the ground will be wet, the grass will grow

④ Disjunctive Syllogism (DS)

$P \vee Q_1$, $\neg P$ conclusion: Q_1 is true

Q_1 = It is raining

Either it is raining or snowing

It is raining ✗

Then, it is snowing

⑤ Bi-conditional:

If $P \rightarrow Q$ is true, $P \rightarrow Q$ and $Q \rightarrow P$ must be true

Conclusion:

$P \rightarrow Q$

$Q \rightarrow P$

⑥ Contradiction

P leads to a contradiction, $\neg P$ must be true

Raining & ground not wet.

conclusion: $\neg(P \wedge \neg Q))$

Solution to the question given:

① Premises from the knowledge base:

P1: $M(A, B)$ Alice is the mommy of Bob

P2: $F(B, C)$ Bob is the daddy of Charlie

P3: $\forall x (F(x, y) \rightarrow P(x))$ if x is dad of y, x is parent of y

P4: $\forall x (M(x, y) \rightarrow P(x))$ " → "mom-", → " →

P5: All parents have children

$\forall x (P(x) \rightarrow \exists y (C(x, y)))$

$\forall x \forall y (P(x) \wedge C(x, y) \rightarrow S(y, z))$ (If x is a parent of y & z, then y & z are siblings)

P6: x has children y & z, then y & z are siblings

P7: Alice is named to dumb

$Mom(A, D)$

Date
Page

(2) Hypothesis:
$S(B, C)$

(3) Entailment Proof

↳ $M(A, B)$ P1

↳ $F(B, C)$ P2

$F(B, C) \rightarrow P(B)$ Reduction P3

$M(A, B) \rightarrow P(A)$ P4

↳ $P(A) \rightarrow \exists y\ (C(A, y))$

Alice, a parent has children.

↳ If someone is a parent, their children are siblings.

A and B are parents. Bob and Charlie are children of Bob and Alice.

Hence, Bob and Charlie are siblings

(4) Conclusion

$S(B, C)$ is entailed by knowledge base

Sneha S
7/2/11/24