ITRI626/ITRW878 - Klastoets 2 - Class test 2 - 23 Augustus / August 2016

**Vraag 1 / *Question 1***

Maak gebruik van logiese ekwivalensies en ‘n bewys om aan te toon dat ¬(P ∨ ¬(P ∧ Q)) ⊨ False. / *Use logical equivalences and a proof to show that ¬(P ∨ ¬(P ∧ Q)) ⊨ False*. [6]

¬(P ∨ ¬(P ∧ Q))

∴ ¬P ∧ ¬(¬(P ∧ Q)) [De Morgan’s Law]

∴ ¬P ∧ (P ∧ Q) [Double Negation Law]

∴ (¬P ∧ P) ∧ Q [Associative Law]

∴ False ∧ Q [Contradiction]

∴ False

Naming the laws: 3 marks, applying the laws: 3 marks.

**Vraag 2 / *Question 2***

Maak gebruik van die resolusie algoritme om aan te toon dat (P ⇒ Q) ⋀ (R ⇒ S) ⊨ (P ∨ R ⇒ Q ∨ S). / *Use the resolution algorithm to show that (P ⇒ Q) ⋀ (R ⇒ S) ⊨ (P ∨ R ⇒ Q ∨ S).* [12]

Let KB = (P ⇒ Q) ⋀ (R ⇒ S)

and α = (P ∨ R ⇒ Q ∨ S)

Thus, show that KB ⊨ α

Convert KB ⋀ ¬α to conjunctive normal form.

1 mark.

∴ Convert (P ⇒ Q) ⋀ (R ⇒ S) ⋀ ¬(P ∨ R ⇒ Q ∨ S) to conjunctive normal form.

(P ⇒ Q) ⋀ (R ⇒ S) ⋀ ¬(P ∨ R ⇒ Q ∨ S)

∴ (¬P ⋁ Q) ⋀ (¬R ⋁ S) ⋀ ¬(P ∨ R ⇒ Q ∨ S) [Implication elimination]

∴ (¬P ⋁ Q) ⋀ (¬R ⋁ S) ⋀ ¬((P ∨ R) ⇒ (Q ∨ S))

∴ (¬P ⋁ Q) ⋀ (¬R ⋁ S) ⋀ ¬(¬(P ∨ R) ⋁ (Q ∨ S)) [Implication elimination]

∴ (¬P ⋁ Q) ⋀ (¬R ⋁ S) ⋀ ((P ∨ R) ⋀ ¬(Q ∨ S)) [De Morgan]

∴ (¬P ⋁ Q) ⋀ (¬R ⋁ S) ⋀ (P ∨ R) ⋀ ¬Q ⋀ ¬S [De Morgan]

5 marks (1 mark for each clause in the correct form).

Let

R1: (¬P ⋁ Q)

R2: (¬R ⋁ S)

R3: (P ∨ R)

R4: ¬Q

R5: ¬S

Resolution between R1 and R4:

R6: ¬P

Resolution between R2 and R5:

R7: ¬R

Resolution between R3 and R6:

R8: R

Resolution between R7 and R8:

R9: □

5 marks for applications of resolution rule. There can be more or less applications as shown here.

Thus, (P ⇒ Q) ⋀ (R ⇒ S) ⊨ (P ∨ R ⇒ Q ∨ S).

1 mark for the conclusion.

Totaal [18] / *Total [18]*