Logic and Set Theory: Review Sheet for Test 1

DeMorgan’s Laws:

 ¬(𝑃∧𝑄) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 ¬𝑃∨¬𝑄

 ¬(𝑃∨𝑄) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 ¬𝑃∧¬𝑄

Distributive Laws:

 𝑃∧(𝑄∨𝑅) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 (𝑃∧𝑄)∨(𝑃∧𝑅)

 𝑃∨(Q∧𝑅) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 (𝑃∨𝑄)∧(𝑃∨𝑅)

Absorption:

 𝑃∨(𝑃∧𝑅) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 𝑃

 𝑃∧(𝑃∨𝑅) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 P

Implications:

 𝑃→ is equivalent to ¬𝑃∨𝑄

 𝑃→𝑄 is equivalent to ¬(𝑃∧¬𝑄)

 𝑃→𝑄 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 ¬𝑄→¬𝑃

Quantifier Negation Laws:

 ¬∃𝑥𝑃(𝑥) 𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜∀𝑥¬𝑃(𝑥)

 ¬∀𝑥𝑃(𝑥)𝑖𝑠 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑡𝑜 ∃𝑥¬𝑃(𝑥)

Definitions of Unions and Intersections and the Power Set:

 ∩ℱ={𝑥│∀𝐴𝜖ℱ(𝑥𝜖𝐴) }={𝑥│∀𝐴(𝐴𝜖ℱ→𝑥𝜖𝐴}

 ∪ℱ={𝑥│∃𝐴𝜖ℱ(𝑥𝜖𝐴) }={𝑥│∃𝐴(𝐴𝜖ℱ∧𝑥𝜖𝐴}

 ℘(𝐴) = {𝐵│𝐵⊆𝐴}