# COMP1003 Maths Worksheet 4a Sets and Logic

In Questions 1-4, S = {1, 2, 3, 4}; T = {2, 3, 4, 5}; U = {4, 6, 8}; V = {6, 7}.

**1.** What is the value of S ∪ T?

**2.** What is the value of S ∩ T?

**3.** What is the value of S / T?

**4.** What is the value of ((S / T) ∪ U) / V?

**5.** Which of the following sets is a *fuzzy* set, rather than a crisp set?

R is the set of real numbers

a. { x | x ∈ R; x > 0}

b. { x | x ∈ R; x2 < 0}

c. { x | x ∈ R; x is very large}

d. { x | x ∈ R; x is infinitely large}

e. None of the above

Consider the formula θ: (p ∧ q) → ¬q. We saw in the lectures that this formula is not a tautology – this can be demonstrated by finding an assignment of truth values (TRUE or FALSE) to the individual propositions (here, p and q) which makes θ false. In this case there was just one such assignment: p=TRUE and q=TRUE.

Recall also that a formula of the form ϕ → μ is false if and only if (iff) ϕ is true and μ is false.

**6.** Demonstrate that the formula θ below is not a tautology by finding an assignment of truth values (TRUE or FALSE) to its individual propositions which makes θ false.

θ: (p → q) → (q → p)

**7.** Demonstrate that the formula θ below is not a tautology by finding an assignment of truth values (TRUE or FALSE) to its individual propositions which makes θ false.

θ: ((¬p ∨ q) ∧ (p ∨ ¬q)) → (p ∧ ¬q)

In the lectures we saw that in order to demonstrate that a formula θ is a tautology, it is necessary to demonstrate that there is no assignment of truth values (TRUE or

FALSE) to the individual propositions in θ which makes θ false.

In the case of a formula of the form ϕ → μ, we can demonstrate that the formula is a tautology by showing that there is no assignment of truth values that makes both ϕ true and μ false.

**8.** Demonstrate that the following formula is a tautology.

(p ∨ q) ∧ (¬p ∨ r) → (q ∨ r)