#### HAWASSA UNIVERSITY

#### Collage of Natural and Computational Science Department of Mathematics

#### Work sheet -1

Basic Mathematics for Natural Sciences

(2014EC)

- 1. Show that the following propositions are equivalent
  - a)  $(P \Longrightarrow O)$  and  $\neg PVO$
- b) Pand PA (OV -O)
- 2. For statements p. q. and r. show that the following compound statements are tautology.
  - a)  $(p \land (p \Rightarrow q)) \Rightarrow q$ . b)  $((p \Rightarrow q) \land (q \Rightarrow r)) \Rightarrow (p \Rightarrow r)$ .
- Let p and a be statements. Which of the following implies that p ∨ a is false?
  - a. −p ∨ −q is false.

c. p => q is true.

b. ¬p v q is true.

- d.  $p \land \neg q$  is true.
- 4. Suppose that the statements P.Q.R. and S are assigned the truth values T.F.F. and T. respectively. Find the truth value of each of the following statements
  - (a)  $R \Longrightarrow (s \land P)$ (b)  $P \Longrightarrow (R \Longrightarrow 5)$ .
- $(c) O \land \neg S \Longrightarrow (P \Longleftrightarrow S).$ 
  - (d)  $(R \land S) \Rightarrow (P \Rightarrow \neg O \lor S)$
- a) If the value of P ⇒ Q, is F, then what is the truth value of (¬P∧Q) ⇔ (PVQ)?
  - b) If the value of P ⇔ Q is T, then what is the truth value of P ⇔ ¬Q and ¬P ⇔ Q?
  - c) If the value of P ← Q is F, then what is the truth value of P ← ¬Q and ¬P ← Q?
- 6. Find the truth value of following compound statements using the given information.
  - a) (p ⇒ q) ⇒ r, where r = T.

- c)  $p \lor (q \Longrightarrow r)$ , where r = T.
- b)  $\neg (p \lor q) \Leftrightarrow (\neg p \land \neg q)$ , where  $p \lor q = T$ . d)  $(p \Rightarrow q) \Rightarrow (\neg q \Rightarrow \neg p)$ , where q = T.

- e)  $(p \land a) \Longrightarrow (p \lor s)$ , where p = T.
- 7. Let P(x,y):  $\frac{\pi}{c} < 1$ , where the domain of x is  $A = \{2,3,5\}$  and the domain of y is  $B = \{2,4,6\}$ . Then determine the truth value of the following quantified statement.
  - a) (∀x ∈ A)(∃y ∈ B)P(x, y).
     b) (∃x ∈ A)(∃y ∈ B)P(x, y).
     c) (∃y ∈ B)(∀x ∈ A)P(x, y).
- 8. Determine the truth value of the following statements.
  - a) (∃x ∈ R)(x² − x = 0).
- e)  $(\exists y \in \mathbb{R})(\exists x \in \mathbb{R})(x^2 + y^2 = 9)$ .
- b)  $(\forall x \in N)(x + 1 \ge 2)$ .
- f)  $(\exists y \in \mathbb{R})(\forall x \in \mathbb{R})(x + y + 3 = 8)$

c)  $(\forall x \in \mathbb{R})(\sqrt{x^2} = x)$ .

- e)  $(\forall x \in \mathbb{R})(\exists y \in \mathbb{R})(x + y = 5)$
- d)  $(\exists x \in \mathbb{Q})(3x^2 27 = 0)$ .
- h)  $(\exists x \in \mathbb{R})(\forall y \in \mathbb{R})(x + y = 5)$
- 9. Investigate the validity of the following argument forms using truth table method.
  - a)  $-p \Longrightarrow -q, q \vdash p$ .

  - $b) p \Rightarrow \neg p. p. r \Rightarrow q \vdash \neg r.$  c)  $p \Rightarrow q. \neg r \Rightarrow \neg q \vdash \neg r \Rightarrow \neg p.$
- 10. Investigate the validity of the following argument forms using formal proof (rule of inference)
  - a)  $-p \Longrightarrow -q, q \vdash p$ .
- c)  $\neg r \land \neg s, (\neg s \Rightarrow p) \Rightarrow r \vdash \neg p$ .
- b)  $p \Rightarrow -q, p, r \Rightarrow q \vdash -r$ . d)  $-q \Rightarrow -p, r \Rightarrow p, -q \vdash r$ . e)  $p \Rightarrow q, -r \Rightarrow -q \vdash -r \Rightarrow -p$ .

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**SA Dillow** 

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