FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
SCHOOL OF INFORMATION & COMMUNICATION TECHNOLOGY
DEPARTMENT OF INFORMATION & MEDIA TECHNOLOGY
SECOND SEMESTER EXAMINATION 2013/2014 SESSION
ICT 224: DISCRETE MATHEMATICS

INSTRUCTION: ANSWER ANY FOUR (4) QUESTIONS
TIME ALLOWED: 2 $^{1/2}$ HRS

1. a) Let $A = \{a, b, c\}$ and $B = \{b, c, d, f, g\}$, Find the following:

   i) $(A \cup B) - (A \cap B)$ ii) $(A - B) \cup (B - A)$ iii) $A \oplus B$ iv) $|A|$ v) $P(A)$

   b) Let $A = \{a, b, c\}$, $B = \{b, c, d\}$ and $C = \{b, c, e\}$. Show that $A - (B - C) = (A - B) - C$

   c) Let $P = \{1, 2, 3, 4, 5, 6\}$, $P_1 = \{1, 2\}$, $P_2 = \{3, 4\}$, $P_3 = \{5, 6\}$. Show that $\{P_1, P_2, P_3\}$ is a partition of P.

2. a) Define the following terms: i) Function ii) Injective function

   iii) Surjective function iv) Inverse Relation v) Inverse Function

   b) Let $A = \{1, 2, 3\}$ and $B = \{2, 3, 4\}$. Let R and S be two binary relations defined from A to B as follows: $(x, y) \in A \times B$, $xRy \leftrightarrow 2/(x - y)$

   $(x, y) \in A \times B, (x, y) \in S \leftrightarrow x \geq y$

   i) Find R ii) Find S iii) Find $R \cup S$

   c) Indicate whether any of the relations R or S in (2b) above is a function. If any, state the type of function, if not give reasons.

3. a) Let Z be the set of integers, show that congruence modulo 2 is an equivalent relation given that: $x \equiv y \ (mod\ 2)$ ("x is congruent to y modulo 2") if and only if $x - y$ is even.

   b) Let Z^+ be the set of non-negative integers and R the relation aRb if a divides b. Show that Z^+ is a poset.

   c) Let $A = \{a, b, c, d\}$ and $R = \{(a, a), (b, c), (c, b), (d, d)\}$.

   i) Show that R is symmetric

   ii) Show that R is not transitive.

4. a) Show that $(r \vee p) \wedge [(\overline{r} \vee (p \wedge q)) \wedge (r \vee q)] \equiv p \wedge q$.

   b) Find the converse, inverse and contrapositive of the proposition "*If n is prime, then n is odd or n is 2.*"

c) Indicate which of the following propositions is a tautology, a contradiction or a contingency.

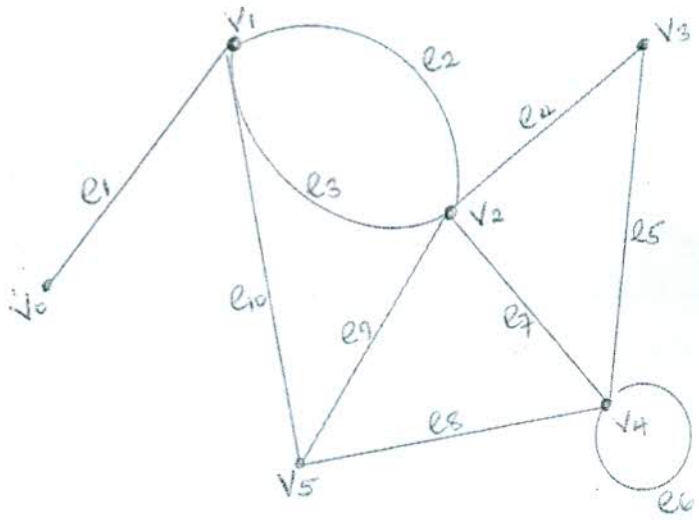
i) $(p \wedge \overline{q}) \wedge (\overline{p} \vee q)$ ii) $(p \wedge q) \vee \overline{(p \wedge q)}$

5. a) Show that $(Z_2, +, ., ^-, 0, 1)$ is a Boolean algebra.

b) Draw a combinatorial circuit for the Boolean expression $y = \overline{(x_1 + x_2).x_3}$.

c) Draw the logic table for the Boolean expression in (5b) above.

6. a) Consider the following graph G.



i) Find E_G,and V_G, ii) Find **card(V)** and **card (E)** iii) List the isolated vertices.

iv) List the parallel edges. v) List the loops. vi) List the vertices adjacent to v_3.

vii) List the vertices adjacent to v_2. viii) Find all edges incident on v_1.

ix) Find the degree of vertex v_4 x) What type of graph is G ?

b) In the graph above, determine whether the following sequences are paths, or circuits.

i. $v_0\, e_1\, v_1\, e_{10}\, v_5\, e_9\, v_2\, e_2\, v_1$. ii) $v_1\, e_2\, v_2\, e_3\, v_1$.

iii) $v_3\, e_5\, v_4\, e_8\, v_5\, e_{10}\, v_1\, e_3\, v_2$. iv) $v_5\, e_9\, v_2\, e_4\, v_3\, e_5\, v_4\, e_6\, v_4\, e_8\, v_5$

c) Draw a complete bipartite graph $K_{4,3}$.

d) Define the following terms:

i. Simple graph. ii) Complete graph. iii)Pseudograph