

**BANGABASI COLLEGE  
TEST EXAMINATIONS, 2014  
PART- II ( 1 + 1 + 1 SYSTEM )  
COMPUTER SCIENCE ( HONOURS )  
THIRD PAPER**

**Full Marks – 100**

**Total Time – 4 Hrs**

**Answer Question No. – 1 and any FIVE questions from the rest taking at least TWO questions from Group A and ONE question each from Group B and Group C.**

**Question No. – 1 : Answer any TEN of the following :**

**10 × 2 = 20**

- a) Differentiate between 'isolated vertex' and 'pendant vertex' of a graph.
- b) What is Euler graph?
- c) State the Konisberg bridge problem in Graph Theory.
- d) Define simple connected graph.
- e) Distinguish between walk and a path in a graph.
- f) Define cut-set of a graph.
- g) What is existential quantifier of a predicate?
- h) Define tautology.
- i) Define an equivalence relation.
- j) Consider two functions  $f(x)$  and  $g(x)$ . Define  $f(x) = \Omega( g(x) )$ .
- k) Give the condition for convergence of Gauss-Seidl iteration method.
- l) In a linear programming problem, what is meant by basic feasible solution?
- m) What is an unbounded solution in L.P.P. ?
- n) What is a Finite State Machine?
- o) Define Mealy Machine.
- p) What is a phrase structure grammar?

**Group – A ( Discrete Mathematical Structures )**

**Question No. – 2 :**

**8 + (2+2+2+2) = 16**

- a) Describe Prim's Algorithm with suitable example.
- b) What is a digraph? Define in-degree and out-degree of a vertex in a digraph. What can you say about the sum of in-degrees and the sum of out-degrees? Illustrate.

**Question No. – 3 :**

**4 + 7 + 5 = 16**

- a) Define the terms Hamiltonian path and Hamiltonian circuit with examples.
- b) Describe Kruskal's algorithm to compute minimal spanning tree with example.
- c) Prove that a simple graph with  $n$  vertices and  $k$  components can have at most  $(n-k)(n-k+1)/2$  edges.

**Question No. – 4 :**

$(3 \times 4) + 4 = 16$

- a) Define the following relations and give one example of each:
- Reflexive Relation
  - Symmetric Relation.
  - Anti-symmetric Relation.
  - Equivalence Relation.
- b) Show that  $(p \vee q) \rightarrow r$  and  $(p \rightarrow q) \vee (q \rightarrow r)$  are logically equivalent.

**Question No. – 5 :**

$5 + 5 + 6 = 16$

- a) State and prove generalized Pigeon Hole principle.
- b) Find the count of all 3 – digit numbers less than 500 that are either divisible by 4 or divisible by 6 but not by both.
- c) How can you relate big-Oh, big-Omega and big-Theta notations? Justify your answer.

**Group – B ( Numerical and Optimization Techniques)**

**Question No. – 6:**

$8 + 8 = 16$

- a) Use Gauss-Jordan method to solve the following system of equations:  
 $4x + y + 2z = 16, x + 3y + z = 10, x + 2y + 5z = 12$
- b) Discuss Gauss-Elimination method using examples.

**Question No. – 7 :**

$8 + 8 = 16$

- a) Discuss Gauss-Seidel iterative method for solving system of linear equations. Give an estimate for convergence.
- b) Solve the following by Gauss Elimination method :
- $$2x + 2y + 4z = 18$$
- $$x + 3y + 2z = 13$$
- $$3x + y + 3z = 14$$

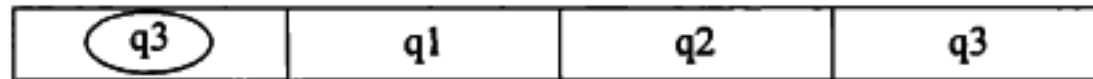
**Group – C ( Automata Theory )**

**Question No. – 8**

$4 + (3 + 3 + 6) = 16$

- a) Differentiate between DFA and N DFA with examples.
- b) Given the following N DFA :

State	Next State		
	Input = a	Input = b	Input = c
$\rightarrow$ q0	q1, q2	q2, q3	q1, q3
q1	q0, q3	q1, q2	q0
q2	q1, q3	q0	q1, q3



- i. Construct transition diagram for the N DFA.
- ii. Test whether the string *abcabcabc* are accepted by the transition system.
- iii. Construct a DFA equivalent to the N DFA.

**Question No. – 9:**

$$4 + 4 + (2 + 2 + 2) + 2 = 16$$

- a) Find the language equivalent to the grammar  $G = ( \{S, A\}, \{0, 1\}, \{ S \rightarrow 0S0|1A2, A \rightarrow 1A2|12 \}, S )$ .
- b) Construct a grammar generating  $\{ x^n y^m x^n \mid n \geq 0, m \geq 1 \}$
- c) What is a context-free grammar? What is its difference with a context-sensitive grammar? Give examples of each.
- d) Define Turing Machine.