**Botswana Accountancy College**

Computing and Information Systems

**B.Sc. Computer Systems Engineering Year 2**

**CIS 226 Discrete Mathematics**

Supplementary Examination

16 July 2014

**Start Time : 2:00PM**

**Duration: 2 hrs**

**Instructions to candidates:**

Candidates must attempt **ALL** questions.

Candidates attempting to gain an unfair advantage or colluding in any way whatsoever are liable to be disqualified

Total Marks: 100

**Do NOT open the question paper until you are told to do so**

**This question paper consists of FOUR (4) printed pages including this page**

**Discrete Maths Supplementary Exam 2014.**

Answer all questions.

# Question 1

1. Translate the following predicates into natural language:
2. ∀ x ∀y ((x > 0) ∧ (y > 0) ⇒ (x + y > 0))
3. ∀ i: 1.10 • ∀ i3 ≤ 1000
4. ∃ queue: AvailableQueues • (QueueStatus(queue, active) **[3]**
5. Convert the following sentences into predicate calculus form.
6. There is a student in this class who has taken at least one course in computer science.
7. There is a student in this class who owns a personal computer.
8. Every computer science student needs a course in discrete mathematics. **[6]**
9. Given A = {1,2,3,4} and B = {x,y,z}. Consider the relation from A to B :

R = [(1,x),(1,z),(2,y),(3,z),(4,y)}

1. Plot R on a coordinate diagram of A x B.
2. Determine the matrix of the relation.
3. Draw the arrow diagram of R. **[6]**
4. Let R be the following relation on A = { 1,2,3,4} : R = {(1,3),(1,4),(3,2),(3,3,),(3,4)}

. i. Find the domain and range of R

1. Draw the directed graph of R.
2. Find R -1 **[6]**
3. Prove that p ∨ (q ∧ r) and (p ∨ q) ∧ (p ∨ r) are logically equivalent. **[4]**

**Total Marks : [25]**

**Question 2**

1. Prove or disprove the following using a truth table
2. p ∨ (p ∧ q) ⇔ p  **[4]**
3. Find the gcd of 414 and 662 using the Euclidean algorithm. **[5]**
4. Evaluate these quantities
5. 155 mod 19
6. 101 mod 11
7. 13 mod 3 **[6]**
8. Define a prime number. **[2]**
9. When are two integers a and b said to be relatively prime. **[2]**
10. Determine whether the integers 10,17 and 21 are pairwise relatively prime **[6]**

**Total Marks : [25]**

**Question 3**

1. Using diagrams define the following:
2. Complete graph
3. Connected graph
4. Weighted graph
5. Rooted Tree **[8]**
6. Construct a complete 3-ary tree of height 3. **[7]**
7. For a rooted tree representing a computer file system, what does each of the following represent:
8. The parent of a vertex
9. A child of a vertex
10. A sibling of a vertex
11. The level of a vertex
12. The height of the tree. **[10]**

**Total Marks : [25]**

# Question 4

# Define the following sets using a comprehensive specification.

1. The set of natural numbers less than 10.
2. The set of pairs of natural numbers whose sum of squares is less than 200.
3. The set of natural numbers which are between 10 and 40.
4. The set of pairs for which the first element is a natural number greater than 10 and the second element is the square of the first. **[8]**
5. Which of the following predicates are true and which are false.
6. {file1,file2} ⊂{ file1,file2,file3}
7. { n: | n < 4} ⊂ { n: | n > 7}
8. {3} ⊂ { n: ⏐n > 2 • n} ∨{3} ⊂ {4,5,6}
9. {3,4,5}∩ ∅ = ∅
10. {1,2,4,8,9} \ {1,2,3} = { 4,8,9}
11. # { n: ⏐n < 4} = 4
12. { n: ⏐n > 5 ∧ n < 10} ∪ { n: ⏐n ≤ 5} = { n: ⏐n < 10} **[7]**

1. Let p be “Marc speaks French and q be “Marc speaks Russian”. Give a simple verbal sentence which describes each of the following.
2. p ∨ q
3. p ∧ q
4. ¬( ¬ p ∧ ¬ q)
5. ¬ p ∨ ¬ q
6. p ∧ ¬ q **[10]**

**Total Marks : [25]**

***End of Paper***