

UGANDA MARTYRS UNIVERSITY
FACULTY OF SCIENCE
FINAL ASSESSMENT EXAMINATION SEMESTER 1 2008-2009
BSC – FM 2: GENERAL TOPOLOGY

DATE: 2nd December-2008

Time: 9.00 – 12.00noon (3 Hours)

Instructions: Attempt any (4) Four questions

1 (a)(i) Given A and B two sets, State De-Morgan's laws of the algebra of sets.
(2 Marks)

(ii) Given the sets

$$S_1 = \{(x,y) / 4 \leq x^2 + y^2 \leq 16\}$$

$$S_2 = \{(x,y) / -4 \leq x \leq 2\}$$

The Universal set U = the set of all real numbers.

Sketch the graph of S_1 , S_2 and $S_1 \cap S_2$ using the same axes. (3 Marks)

(b) Simplify the following using the laws of sets.

i) $A' \cup [(B' \cup A) \cap B']$ (4 marks)

ii) $(A \cap B) \cup (A \cap B') \cap (A \cup B') \cup (A \cap B')$ (4 Marks)

(c) Show by shading the regions represented by the following (2 marks)

(i) $[B \cap (A \cap C')]' \cap B'$ (3 marks)

(ii) $(A' \cap B') \cup [(B-A) \cap C']$

(d) When is a set said to be an open set? Give one example, of an open set.
(2 marks)

2(a) (i) What is meant by the term partition of a set Q. (2 marks)

(ii) Given a set $M = \{a,b,c,d,e\}$, List all the 3-cell partitions of the set M.
(4 marks)

(iii) Given the set $X = \{2,3,a,b\}$ and the following partitions on X

$$P_2 = [\{2\}, \{3,a,b\}]$$

$$P_3 = [\{2,3\}, \{a\}, \{b\}]$$

Find the cross partition $P_2 \times P_3$. (2 marks)

(b) Of the 120 students who offered Mathematics at a certain college. It was identified that they also offered languages like French (F), Germany (G) and Russian (R). 65 study French, 45 study German, 42 study Russian, 20

study French and Germany, 25 study French and Russian, 15 study German and Russian, the number of those who take none of the three languages exceeds that of those who study all by 12. Represent the given information on a Venn-diagram and use it to find. (4 Marks)

- (i) The number of students who offer four subjects. (2 marks)
(ii) $n([(F \cup G) \cap R] \cup G)$ (3 marks)
- (c) List all the subsets of the set $L = \{4, 5, g\}$. (3 Marks)

3 (a) (i) What is a relation? (1 marks)

(ii) When is a relation said to be

- Symmetric

- Reflexive

- Transitive?

(3 marks)

(b) Given the sets $M = \{k, l, p\}$ and $N = \{3, 6\}$, Formulate two relations in each case from the set M to the set N , which are

(i) Symmetric

(ii) Reflexive

(iii) Transitive.

(6 marks)

(c) Given the sets $A = \{1, 2, 3\}$, $B = \{a, b, c\}$ and $C = \{x, y, z\}$.

The relations R and P are defined as

R : is a relation from A to B .

$R = \{(1, b), (2, a), (2, c)\}$

P is a relation from B to C such that

$P = \{(a, y), (b, x), (c, y), (c, z)\}$

(i) Find the following relations

(a) $R \circ P$ (b) R^c (c) $P^{-1} \circ R^{-1}$ (6 marks)

(ii) Find the Matrix of the relation $R \circ P$. (1 marks)

(iii) Compute $M = M_R M_P M_R^{-1}$, the product of the Matrices of the relations R , P and R^{-1} . (3 marks)

4 (a) When is a function said to be

(i) one to one

(ii) Onto?

(2 marks)

(b) Draw the graphs of the following functions and use them to determine whether they are one to one or onto.

(i) $f(x) = 2x^2 - 5x - 3$, where the domain is the set of all real numbers. (3 marks)