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**University Examinations 2016/2017**

FOURTH YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COM PUTER SCIENCE.

**SMA 2401: TOPOLOGY I**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Define the following terms as used in topology
2. Topological space (4 marks)
3. Limit point (1mark)
4. Interior of a set (2 marks)
5. Given the collection of subsets of X, determine whether is a topology on X. (3 marks)
6. Let X and let  and . Find the topology on X generated by , donated TA  (5 marks)
7. (i) define a Hausdorff space (2 marks)

(ii) prove that the property of being Hausdorff is hereditary. (5 marks)

1. Given that  is a topology on X. List the closed subsets of X. (5 marks)
2. Prove that a discrete space X is separable if and only if it X is countable. (3 marks)

**QUESTION TWO (20 MARKS)**

Given that the topology  on ;

1. List the closed subsets of X (6 marks)
2. Determine the closure of the sets  and  (10 marks)
3. Which sets in (b) above are dense? (4 marks)

**QUESTION THREE (20 MARKS)**

1. Given that  is a topology on X  and that  is a subset of X. Find;
2. The interior points of A (4 marks)
3. The boundary of A (4 marks)
4. (i) Define a homeomorphic function from a topological space X to a topological space Y. (2 marks)

(ii) Show that the closed interval  is homeomorphic to the closed unit interval  (5 marks)

1. Given that  is a subset prove that A is a nowhere dense set (5 marks)

**QUESTION FOUR (20 MARKS)**

1. Given the topology  on  list the neighbourhoods of:
2. Point e (8 marks)
3. Point c (5 marks)
4. Given the topologies on  and respectively;

 and  ,given also that the function  and  defined by the diagram

Determine whether the functions f and g are continuous. (7 marks)

**QUESTION FIVE (20 MARKS)**

1. Prove that if A is a subset of B, then every limit point of A is also a limit point of B ieimplies  (6 marks)
2. Let T1 and T2 be topologies on x such that ie every T1-open subset of X is also a T2-open subset of X and let A be any subset of X.
3. Show that every T2-limit point of A is also a T1-limit point of A. (7 marks)
4. Construct a space in which a T1-limit point is not a T2-limit point. (7 marks)