## JOMO KENYATTA UNIVERSITY

**OF**

**AGRICULTURE AND TECHNOLOGY**

# University Examinations 2016/2017

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY**

**SMA 2100 : DISCRETE MATHEMATICS**

**DATE: AUGUST 2017 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER**

**TWO QUESTIONS.**

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**QUESTION ONE (30 MARKS)**

(a) Define the following terms as used in Discrete Mathematics: [4 marks]

(i) Propositional statement.

(ii) A set.

(iii) Logic.

(iv) Disjoint set.

(b) Given that A = {0,1,2,3,4,5} and B = {1,3,5,7,9} find the following: [8 marks]

(i) AB

(ii) AB

(iii) A-B

(iv) B-A

(v) AB

(c) Find the domain of the following functions: [8 marks]

(i) f(x) = 

(ii) f(x) = 

(iii) f(x) = 

(d) Prove by induction that: [6 marks]



(e) Construct truth tables for: 4 marks]

(i) Conjunction (AND)

(ii) Disjunction (OR)

**QUESTION TWO (20 MARKS)**

(a) P is “the printer is off-line”

q is “the printer is out of paper”

r is “the document has finished printing”

Write as English sentences, in as natural way as you can: [8 marks]

(i) pvq

(ii) rq

(iii) qr

(iv) ( pvq)

(b) Prove by contradiction that  is an irrational number. [4 marks]

(c) Construct truth tables for:

(i) pv(qr), and

(ii) (pvq) (pvr)

and hence show that these propositions are logically equivalent. [8 marks]

**QUESTION THREE (20 MARKS)**

(a) If U = (1,2,3,4,5,6,7,8,9}, A = {3,6,9,4};

B = {6,9,7,1} and C = {1,2,8}

Find:

(i) AB

(ii) BC

(iii) ABC

(iv) AB

(v) AB

(vi) AB

(vii) {A(BC)}

(viii) (ABV

(ix) A-(B-C)

(x) (AB)-(AVC)

[10 marks]

(b) Prove that A(BC) (AVR) (AC) [4 marks]

(c) Let A = B + C = R, where R is the set of all real numbers:

let f: R  R be defined by f(x) = 4+ 2x – 1

and let g = R  R be defined by g(x) = 3x – 2

Show that gof fog [6 marks]

**QUESTION FOUR (20 MARKS)**

(a) Let f(x) = 2+ x + 5 and g(x) = 3 + 2x – 1, find the following: [10 marks]

(i) Domain of f

(ii) Domain of g

(iii) (f+g)(x)

(iv) Domain of (f+g)(x)

(v) (f.g)(x)

(vi) Domain of f.g(x)

(vii) (x)

(viii) Domain of (x)

(b) Given that f(x) = + 2 and g(x) = , find: [6 marks]

(i) The composite function (gof)(x) and its domain.

(ii) The composite function (fog)(x) and its domain.

(c) Define the following two statements and give their equivalent truth tables: [4 marks]

(i) Tautology.

(ii) Contradiction.

**QUESTION FIVE (20 MARKS)**

(a) Let P = {n:n is prime and 1n13} and Q = {n: n is prime and In13}:

(i) Write down the elements in set P and set Q. [2 marks]

(ii) Write down the elements in set P and set Q. [2 marks]

(iii) Use (i) above to compute: [6 marks]

(I) PQ (II) PQ (III) P-Q (IV) Q-P (V) PQ

(b) In a survey of two randomly chosen students, a marketing questionnaire included the following 3 questions:

(i) Do you own a TV?

(ii) Do you own a car?

(iii) Do you own a TV and a car?

75 answered Yes to (i), 45 answered Yes to (ii) and 35 answered Yes to (iii).

(I) Represent your answers in a Venn diagram. [4 marks]

Use your Venn diagram to answer the following:

(II) How many students owned either a car or a TV?

(III) How many students did not own either a car or a TV?

(IV) How many students owned a car but not a TV?

(V) How many students did not own both a car and a TV?

[6 marks]