**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATION 2017/2018**

**FIRST YEAR SEMESTER 1 EXAMINATION FOR BACHELOR OF SCIENCE IN ACTUARIAL SCIENCES, FINANCIAL ENGINEERING, OPERTAIONS RESEARCH**

**SMA 2100: DISCRETE MATHEMATICS**

**DATE: JANUARY 2018 TIME 2: HOURS**

**INSTRUCTIONS: Answer question ONE and any other TWO questions**

**QUESTION ONE (COMPULSORY)**

1. If *U= {a, b, c, d, e, f, g, h}, A={a, b, c, d, f}, B={f, g, h}* Find (A ∩ B’) U (B- A) (4 marks)
2. If |*U*|=71, |H’|=10, |K|=12, and |H’∩ K’|=3, find |H ∩ K’| (4 marks)
3. Prove that for any set S, { } S (2marks)
4. Let f:**R R** with f(x)=x2 . Determine whether f is one-to-one and onto (4 marks)
5. Prove that if *n* is an integer and 3*n*+2 is even, then *n* is even using
6. A proof by contrapositive (3 marks)
7. A proof by contradiction (3 marks)
8. Write the converse, inverse and contrapositive of the following statement “if 2+3=5,then pigs can fly”
9. Determine whether these compound propositions are true or false.

i)If 1+1=2, then pigs can fly

ii) 2+9=11 or Kenya is in Europe

iii)All Africans are white if and only if Kenya is in Europe

iv)0>1 and 2>1 (4 marks)

1. Let the domain be the set of integers. Determine the truth value of the following
2. $∀$x $\in $ *U*(x2.≥0) (1 mark)
3. $∀x \in $ *U*(x+3=10) (1 mark)
4. $∃$x$\in $ *U*(X2-5x+6=0) ( 1 mark)

**QUESTION TWO**

1. Let *A*={1,2, 3,4} and B={$∝,β,ε$}. Find P(B),the power set of B and A × B ,the Cartesian product of A and B (5 marks)
2. Use rules of inference to show that the hypotheses “Randy works hard,” “If Randy works hard, then he is a dull boy,” and “If Randy is a dull boy, then he will not get the job” imply the conclusion “Randy will not get the job.” (7 marks)
3. Prove that if *n* is an integer, these four statements are equivalent :
4. *n* is even,
5. *n+1* is odd
6. *3n+1 is odd*
7. *3n is even.*  (8 marks)

**QUESTION THREE**

1. Prove $\sqrt{5}$ is irrational by contradiction (6 marks)
2. In a survey including 60 people, 25 take milk,26 tea and 26 coffee, 9 like both milk and tea, 11 like milk and coffee, 8 like coffee and tea and 8 like none of the three drinks
3. Draw a Venn diagram representing this information. ( 4 marks)
4. Find the number of people who like coffee, tea and milk alone (4 marks)
5. Prove by principle of mathematical induction that $\frac{1}{1.2}$ + $\frac{1}{2.3}$ +$\frac{1}{3.4}$ + …+$\frac{1}{n(n+1)}$= $\frac{n}{n+1}$ (6 marks)

**QUESTION FOUR**

1. Let *f,h:***R**$\rightarrow $**R** be defined by f(x)=3x+2 and h(x)=x2 + 2x+1. Find :
2. hof (2 marks)
3. (foh)(2) (2 marks)
4. Determine whether f is invertible and if so find f-1 (5 marks)
5. Use mathematical induction to prove that 9n- 1 is divisible by 8$∀$n$\in $**N**  (5 marks)
6. Determine whether [(*p v q)* $ʌ$(*p* $\rightarrow $*r*)ʌ (*q* $\rightarrow $ *r*)]$\rightarrow $r is a tautology (6 marks)