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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE**

**IN ACTUARIAL SCIENCE**

**3RD YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR**

**(REGULAR) MAIN CAMPUS**

**COURSE CODE: SAS 305**

**COURSE TITLE: STOCHASTIC PROCESSES I**

**EXAM VENUE: STREAM: Bsc. ACTUARIAL SCIENCE**

DATE: EXAM SESSION:

TIME: 2.00 HOURS

**Instructions:**

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

**QUESTION ONE (30 MARKS)**

1. Find the generating function for the sequence:



1. i. Prove the identity:



ii. Use the identity to determine the p.g.f of a negative binomial distribution.

1. i. Give a transition matrix for the following diagram:

1 



ii. Draw a transition graph (diagram) for the following transition matrix.



1. Let  and  where is the first time a birth process is of size .
2. Find the relationship between and
3. If for , find and
4. i. Simplify by elimination method and by binomial expansion.

ii. Equating the two results find the formula for .

**QUESTION TWO (20 MARKS)**

The basic difference differential equations for a simple birth process are;

 (1)

and

 (2)

For 

1. Use the iteration technique to solve for given that 
2. Multiply (2) by and then sum the result over 

Let  and  If ,

Solve for 

**QUESTION THREE (20 MARKS)**

1. Obtain the sum  given that 

and 

1. Given that  for find and 

**QUESTION FOUR (20 MARKS)**

A drunkard walks along a four-block stretch of Park Avenue. If he is at corner 1, 2 or 3, then he walks to the left or right with equal probability. He continues until he reaches corner 4, which is a bar, or corner 0, which is his home. If he reaches either home or the bar, he stays there.

1. i. Form a markov chain with states 0,1,2,3 and 4

ii. Draw the transition diagram

1. Re-organize the transition matrix to be of the form



Where is a 2X2 identity matrix, what is and ?

1. State an expression for and apply it to this absorbing matrix.

**QUESTION FIVE (20 MARKS)**

An insurance company operates a No-claim discount system with discount levels of 0%, 30%, 40%, 50% and 60%. The rules are as follows;

1. At the end of a claim-free year, a policy –holder moves up one level or remains on maximum discount.
2. At the end of a year in which exactly one claim was made, a policy-holder drops back two levels (or moves to zero discount)
3. At the end of a year in which more than one claim was made, a policy-holder drops back to zero discount.

For a particular driver in any year, the probability of a claim free-year is 0.7, the probability of exactly one claim is 0.2 and the probability of more than one claim is 0.1

1. Write down the transition matrix for this markov chain.
2. Draw the transition graph.
3. Calculate the transition probabilities 
4. If the policy-holder starts with no discount, what is the probability that he/she is at maximum discount 6 years later?