# FOUNTAIN UNIVERSITY OSOGBO, NIGERIA

P.M.B.4491, OSOGBO, OSUN STATE.

## COLLEGE OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES
2020/2021 SECOND SEMESTER EXAMINATIONS

**STA 210: Probability II** **Credit Unit/Status: 3 (C)**
**Time Allowed: 2hrs** **Date: 31/08/2021**
INSTRUCTION(s): Answer **ANY 4 THE QUESTIONS**

### QUESTION ONE

(a) Define the following terms and give example of each;

(i) A Trial (2 Marks)

(ii) A Random variable (2 Marks)

(iii) An Outcome (2 Marks)

(iv) Sample space (2 Marks)

(v) An Independent Event (2 Marks)

(bi) Define the $r^{th}$ moments about the mean for both discrete and continous random variables. (2.5 Marks)

(bii) Find an expression for the $3^{rd}$ moments about the mean (2.5 Marks)

### QUESTION TWO

(a) State without proof the Baye's theorem. (5 Marks)

5

(b) A fair die is tossed once. Let $Y_1$ denote twice the number appearing, and Let $Y_2$ denote 1 or 3 accordingly as an odd and an even number that appears. Find;

$\frac{7}{12}$

(i) the distribution of $Y_1+Y_2$ (5 Marks)

(ii) the Expectation of $Y_1 + Y_2$ (5 Marks)

### QUESTION THREE

(a) Every Saturday a fisherman goes to the river, the sea and a lake to catch fishes with probabilities 1/4 , 1/2 , and 1/4 , respectively. If he goes to the sea, there is an 80% chance of catching fish, the corresponding figures for the river and the lake are 40% and 60% respectively.

(i) Find the probability that he catches fish on a given Saturday. (5 Marks)

(ii) What is the probability that he catches fish in at least three of the five consecutive Saturdays? (5 Marks)

(iii) If on a particular Saturday, he comes home without catching anything, where is it most likely he has been? (5 Marks)

## QUESTION FOUR

(b) A pair of dice is rolled once, let X be a random variable denoting the sum of two numbers that appear;

(i) Obtain the probability density of X. (3 Marks)

(ii) Obtain the cumulative density function of X and its graph. (4 Marks)

(a) A bag contains 10 white balls and 15 black balls. Two balls are drawn in succession with replacement, what is the probability that;

(i) the first ball is black and the second is white (2 Marks)

8

(ii) both are black (2 Marks)

(iii) both are of different colour (2 Marks)

(iv) the second is black given that the first is white (2 Marks)

## QUESTION FIVE

(a) State the probability mass function (pmf) of the following probability distribution;

(i) Bernoulli distribution (1.5 Marks)

(ii) Binomial distribution (1.5 Marks)

(iii) Poisson distribution (1.5 Marks)

(iv) Geometric distribution (1.5 Marks)

(b) A student has the opportunity of retaking a public examination as much as he likes until he passes it. The teacher, after observing the student's level of preparation, put his chance of passing the examination in any attempt at 52%. If he must pass the exam, going by the teacher's belief, what is the probability that;

(i) he takes the examination at most three times? (3 Marks)

(ii) he does not pass in the first attempt? (3 Marks)

(iii) Find the expected number of times he will sit for exam. (3 Marks)

## QUESTION SIX

(a) A coin is tossed three times, let X representing number of heads be a random variable defined as;

| x | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(x) | 1/8 | P | q | 1/8 |

9

(i) Obtain the values of p and q (3 Marks)

(ii) Compute E(X) (3 Marks)

(iii) Show that the probability function is indeed a true probability function (3 Marks)

(b) Given that;

$$f(x) = \begin{cases} kx, & 0 \le x \le 5 \\ 0, & elsewere \end{cases}$$

(i) Find K (3 Marks)

(ii) Calculate $\Pr(2 \le x \le 4)$ (3 Marks)

9
4
13 + 12
25
8
33
4
37

# FOUNTAIN UNIVERSITY, OSOGBO

## COLLEGE OF NATURAL AND APPLIED SCIENCES

## DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

## SECOND SEMESTER 2010/2011 EXAMINATION

## STA 210 – PROBABILITY II

**INSTRUCTION(S): Attempt Any *Four* Questions**

**Time Allowed: 2hours**

1(a) Suppose $X \sim N(\mu, \sigma^2)$, show that $E(x) = \mu$, $V(x) = \sigma^2$

(b) State and prove any five properties of a variance.

(c) The probability that A can solve a problem in STA 210 is 0.5, that B can solve is 0.33, and C can solve it is 0.2. If all of them try independently, then find the probability that the problem will be solved.

2(a) Define the $r^{th}$ moments of the distribution for both discrete and continuous random variable.

(b) Find an expression for $5^{th}$ and $6^{th}$ moments about the mean.

(c) Compute the variance of X, where X represents the number of points rolled with a balanced dice. (Hint: Use the knowledge of moments)

3(a) State and prove Baye's theorem

(b) In a certain factory, machines X, Y and Z are producing springs of the same strength. Out of their production, Machines X, Y and Z produce 2%, 1% and 3% defective springs in the factory. Of the total production of springs in the factory, machine X produces 35%, Y produces 40% and the remaining by the third machine. (i) If a spring is selected at random from the total spring produced in a day, what is the probability that it is defective? (ii) If the selected spring is defective, determine the probability that the spring is produced by Y.

(c) In how many ways can you arrange the letters of the word (i) undergraduate (ii) probability?

4(a) Derive the mean and variance of the following distributions:

(i) Binomial (ii) Geometric

(b) Given a probability density function defined by $f(x)=kx^2$, $0<x<2$ find k, mean and Var. of X

(c) State and prove the Chebyshev's inequality

5(a) Show that the mean and variance of a Poisson distribution are the same.

(b) Define moment generating function (mgf) and obtain the mgf of a named discrete distribution. Hence, derive its mean.

(c) Derive the mean and variance of a named continuous probability function

6 Write briefly on the following statistical terms:

(a) Joint probability density function

(b) Application of Baye's theorem

(c) Uniqueness theorem

(d) Random Variable

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P.M.B.4491, OSOGBO, OSUN STATE.

## COLLEGE OF NATURAL AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES
2017/2018 SECOND SEMESTER EXAMINATIONS

**STA 210: Probability II**
**Time Allowed: 2hrs**
INSTRUCTION(s): Answer **ANY 4 THE QUESTIONS**

**Credit Unit/Status: 3 (C)**
26/07/2018

### QUESTION ONE

(a) A coin is tossed three times, let X representing number of heads be a random variable defined as:

| x | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| p(x) | a | 3/8 | b | 1/8 |

(i) Obtain the values of a and b

(ii) Show that the probability function is indeed a true probability function.

(iii) Compute E(X) and Var(X) of the appearance of head.

(b) Given that;

$$f(x) = \begin{cases} kx, & 0 \le x \le 5 \\ 0, & elsewere \end{cases}$$

(i) Find K (ii) Calculate $\Pr(1 \le x \le 3)$

### QUESTION TWO

(a) Define the following terms and give example of each;

(i) A Trial (ii) Random variable (iii) An Outcome (iv) Sample space (v) Independent Event

(bi) State and proof the Baye's theorem.

(bii) Three machines O, Q and R produce 55%, 25%, and 20% respectively of total number of items in a factory. The percentages of defective output of these machines are 2%, 3%, and 4% respectively. An item is selected at random and found defective. Find the probability that the item was produced by machine R.

### QUESTION THREE

(a) A fair die is tossed once. Let $X_1$ denote twice the number appearing, and Let $X_2$ denote 1 or 3 accordingly as an odd and an even number that appears. Find;

(i) the distribution of $X_1X_2$

(ii) the Expectation of $X_1X_2$

(b) If X and Y are two continuous random variables with joint density function;

$$f(x,y) = \begin{cases} \tfrac{1}{4}(2x+y) & 0 \le x \le 1,\ 0 \le y \le 2 \\ 0\ , & \text{otherwise} \end{cases}$$

(i) Find the conditional density of Y given X.

## QUESTION FOUR

(a) In how many ways can five people be seated at a round table if:

(i) They can sit anywhere?

(ii) Two particular people must sit together?

(b) A bag contains 10 white balls and 15 black balls. Two balls are drawn in succession with replacement, what is the probability that;

(i) the first ball is black and the second is white

(ii) both are black

(iii) both are of different colour

(iv) the second is black given that the first is white

## QUESTION FIVE

(a) Let W be a random variable with the distribution h(w). the $r^{th}$ moment is defined as

$E(X^r) = \Sigma X^r h(w)$; Find the first three moment of w if w has the following distribution:

| W | -1 | 2 | 3 | 5 |
|---|---|---|---|---|
| h(w) | 1/5 | 2/5 | 1/5 | 1/5 |

(b) Write short note on the following probability distributions and give two examples of each;

(i) Bernoulli distribution

(ii) Binomial distribution

(iii) Poisson distribution

## QUESTION SIX

(a) Let X be a random variable with Binomial distribution B(k; n. p).

(i) Obtain the moment generating function of X

(ii) Show that E(X) = np

(b) Suppose Fountain University (FU) Football team has probability 2/3 of winning whenever it plays with Crescent University Abeokuta. If FU plays four games, find the probability that it wins:

(i) Exactly two games

(ii) At least one game

(iii) More than half of the game

FOUNTAIN UNIVERSITY OSOGBO

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

STA210 TEST

**INSTRUCTION: Answer ALL Questions**

## QUESTION ONE

(a) A pair of dice is rolled once, let X be a random variable denoting the sum of two numbers that appear;

(i) Obtain the probability density of X.

(ii) Obtain the cumulative density function of X and its graph.

(b) Given that; $f(x) = \begin{cases} kx, & 0 \leq x \leq 5 \\ 0, & elsewere \end{cases}$

(i) Find K

(ii) Calculate $\Pr(2 \leq x \leq 4)$

## QUESTION TWO

(a) Given that;

$$f(x) = \begin{cases} \frac{xy^2}{30}, & x = 1,2,3; y = 1,2 \\ 0, & elsewhere \end{cases}$$

Show that X and Y are independent

(b) A fair die is tossed once. Let X denotes twice the number appearing, and Let Y denotes 1 or 3 accordingly as an odd and an even no that appears, Find the distribution of X + Y.

$k25/2$

$k(5)^2/2$ $x=1=2$ $1/36$ $x>2$

$x=2=3$ $2/36$ $2\leq$

$kx^2/2$

FOUNTAIN UNIVERSITY, OSOGBO NIGERIA

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

MID SECOND SEMESTER TEST 2014/2015 SESSION

COURSE CODE: STA 210 (PROBABILITY II)

**INSTRUCTION: Answer ALL Questions** **Time: 1hr**

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## QUESTION ONE

(a) A coin is tossed three times, Let X be a random variable representing number of heads defined as;

| X | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(X=x) | a | 3/8 | b | 1/8 |

(i) Obtain the value of a and b
(ii) Show that the probability function is indeed a true probability function.
(iii) Compute E(X) and Var(X) of the appearance of head.

(b) Given that;

$$f(y) = \begin{cases} \frac{1}{2} - ky\ ; & 0 \le y \le 4 \\ 0 & \text{otherwise} \end{cases}$$

(i) Find K
(ii) Calculate $P(1 < y < 2)$

## QUESTION TWO

(a) A pair of dice is rolled once, let Y be a random variable denoting the sum of two numbers that appear;

(i) Obtain the probability density of Y.

(ii) Obtain the cumulative density function of Y and its graph.

(b) If A, B, and C are independent events then show that each of the following pairs is also independent.
(i) $A\ B\ C^{l}$
(ii) $A\ B^{l}C^{l}$
(iii) $A^{l}B^{l}C^{l}$

FOUNTAIN UNIVERSITY, OSOGBO NIGERIA

DEPARTMENT OF MATHEMATICAL AND COMPUTER SCIENCES

MID SECOND SEMESTER TEST II 2013/2014 SESSION

COURSE CODE: STA 210 (PROBABILITY II)

**INSTRUCTION: Answer ALL Questions** **Time: 45min**

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## QUESTION ONE

(a) A fair die is tossed once. Let X denotes twice the number appearing, and Let Y denote 1 or 3 accordingly as an odd and an even number that appears. Find;

(i) the distribution of XY and X+ Y

(ii) the expectation and variance of XY

(b) State and proof the Baye's theorem.

## QUESTION TWO

(a) Let X be a random variable with Binomial distribution B(k; n, p).

~~(i)~~ Obtain the moment generating function of X

(i) Show that E(X) = np and Var(X) = npq

(b) Given that;

$$f(x,y) = \{ xy^2/30 \; ; \qquad x = 1,2,3; \; y = 1,2$$

(i) Obtain the marginal distribution of X

(ii) Obtain the marginal distribution of Y

(iii) Obtain the conditional probability density function of X given Y

(iv) Obtain the conditional probability density function of X given Y