

Department of Statistics
Ahmadu Bello University, Zaria
First Semester Examination 2018/2019 Session
STAT201: Probability and Discrete Probability Distributions

Instruction: Answer Any Four Questions.

Time Allowed: $2\frac{1}{2}$ Hours

✓ (1) Compute the following binomial probabilities directly from the formula for $b(x; n, p)$.

(a) $b(3; 8, 0.4)$ and $P(2 \leq X < 5)$ when $n=8$ and $p=0.4$

(b) Suppose that in manufacturing process, the probability of a certain item being defective is $p=0.05$. Suppose that the quality of an item is independent of the quality of the other manufactured items. An inspector selects six items at random and let X equal the number of defective items in the sample space. How is X distributed? Find the probability of at most two defective and at least two defectives.

(2a) Let the random variable X follows a Geometric distribution with the probability mass function given by $P(X = x) = pq^r$ $r = 1, 2, \dots, \infty$

(i) Derived the expectation of the random variable X

(ii) Find the standard deviation of X

b) The number of cracks in a section of interstate highway that are significant enough to require repair is assumed to follow a Poisson distribution with a mean of two cracks per mile (i) What is the probability that there no cracks that require repair in 5 miles of high way? (ii) What is the probability that at least one crack requires repair in one-half mile of high way? (iii) If the number of cracks is related to the vehicle load on the highway and some section of the highway have a heavy load of vehicles while other section carry a light load, how do you feel about the assumption of a poison distribution for the number of cracks that require repair?

✓ (3a) Define the following

(i) Probability (ii) Statistical Experiment (iii) Trial (iv) Outcome (v) Event

(b) In a certain factory, four canteens are in operation. It is on record that the 2000 workers patronize any of these canteens. If 650 patronize canteen A, 500 Canteen B, 450 Canteen C and 400 Canteen D. On a certain day out of which 5, 3, 4, 7 workers respectively that eat in each of the Canteen complained of Stomach ache, one worker was hospitalized for Stomach ache. What is the probability that the worker ate from Canteen B?

✓ (4) Two women A and B share an office with a single telephone. The probability that any call will be for A is $\frac{2}{3}$. Suppose that A is out of her office during the office hours half of the time and B one third. Find the probability that for any call during the working hours

(i) No one is in to answer the call;

(ii) A call can be answered by the person being called;

(iii) Two successive calls are for the same women;

(iv) A caller who wants A has to try more than two times to get her.

(5a) States the condition(s) necessary for a distribution to be call Binomial.

(b) State the properties of the Binomial distribution

(c) Assume that a discrete random variable X follows a Binomial distribution.

i. Find the moment generating function of X .

ii. Obtain the expectation of X . Hence or otherwise find the standard deviation of X .

✓ (6) Suppose a random variable X follows Negative Binomial distribution with the PMF given as

$$p(x; r, p) = \binom{r+x-1}{x} p^r q^x \quad x = 0, 1, 2, \dots$$

Find the expectation and variance of X

$$E(X) = \binom{r-1}{0}$$

Ahmadu Bello University, Zaria
Department of Statistics
First Semester Continuous Assessment for 2018/2019 Session
STAT201: Discrete Probability Distributions

Instruction: Answer Any Three Questions. Time Allowed: 1 Hour

(1) Compute the following binomial probabilities directly from the formula for $b(x; n, p)$.

a.) $b(3; 8, 0.4)$ and $P(2 \leq X < 5)$ when $n=8$ and $p=0.4$.

b) Suppose that in manufacturing process, the probability of a certain item being defective is $p=0.05$. Suppose that the quality of an item is independent of the quality of the other manufactured items. An inspector selects six items at random and let X equal the number of defective items in the sample space. How is X distributed? Find the probability of at most two defective and at least two defectives.

(2) Let the random variable X follows a Geometric distribution with the probability mass function given by $P(X = x) = pq^r \quad r = 1, 2, \dots, \infty$

(i) Derived the expectation of the random variable X

(ii) Find the standard deviation of X

b) The number of cracks in a section of interstate highway that are significant enough to require repair is assumed to follow a Poisson distribution with a mean of two cracks per mile (i) What is the probability that there no cracks that require repair in 5 miles of high way? (ii) What is the probability that at least one crack requires repair in one- half mile of high way? (iii) If the number of cracks is related to the vehicle load on the highway and some section of the highway have a heavy load of vehicles while other section carry a light load, how do you feel about the assumption of a poison distribution for the number of cracks that require repair?

(3a) Define the following

(i) Probability (ii) Statistical Experiment (iii) Trial (iv) Outcome (v) Event

b) In a certain factory, four canteens are in operation. It is on record that the 2000 workers patronize any of these canteens. If 650 patronize canteen A, 500 Canteen B, 450 Canteen C and 400 Canteen D. On a certain day out of which 5, 3, 4, 7 workers respectively that eat in each of the Canteen complained of Stomach ache, one worker was hospitalized for Stomach ache. What is the probability that the worker ate from Canteen B?

(4) A bag contains 10 white balls and 15 black balls. Two balls are drawn in succession with

(a) replacement (b) without replacement. What is the probability that

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

(ii) Both are black

(iii) Both are of the same colour

(iv) Both are of different colours

(v) The second is black given that the first is white