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Discrete probability distribution problems and solutions pdf

PROBABILITY, STATISTICS AND NUMERICAL METHODS
(Common to CSE, IT & CE)

Course Code: 13BM1103   L   T   P   C
                             4   1   0   3

Pre requisites:
- Fundamentals of Set theory and calculus.
- Basic concepts of Probability and Discrete Random Variables.

Course Educational Objectives:
To acquaint students with the fundamental concepts of probability and statistics and to develop an understanding of the role of statistics in engineering. Also to introduce Numerical techniques to solve the real world applications.

Course Outcomes:
Upon successful completion of the course, the students should be able to
- Calculate fundamental concepts such as the cumulative distribution function, expectations, and distributions of random variables.
- Evaluate estimators, construct confidence intervals, and perform hypothesis tests.
- Solve engineering problems using Numerical techniques.

UNIT-I   (12 Lectures)

Review of basic concepts in Probability and Discrete Random variables, Continuous Random variables - Probability density, Distribution. Calculating probabilities from Probability density, Determining Mean and Variance using Probability density, Normal Distribution- Density and Properties. Calculating Normal Probabilities, Normal Approximation to Binomial Distribution, Uniform Distribution.

(5.1, 5.2, 5.3, 5.5 of [1])

G V P College of Engineering (Autonomous)   2013

Rolling Two Dice

Dice 1	1	2	3	4	5	6
Dice 2	1	2	3	4	5	6

Total Possible Outcomes
= Dice 1 Outcomes x Dice 2 Outcomes

How many possible outcomes are there? 6 x 6 = 36

Fill in the table with the possible outcomes.
The possible outcomes of one dice are listed on the top row. The possible outcomes of the second dice are listed in the first column. Add the dice total and fill in roll totals of the 36 possible outcomes.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

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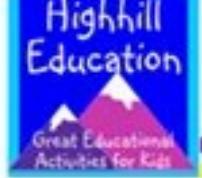
	Order Does Matter	Order Doesn't Matter
With Replacement	n^k	$\binom{n+k-1}{k}$
Without Replacement	$\frac{n!}{(n-k)!}$	$\binom{n}{k}$
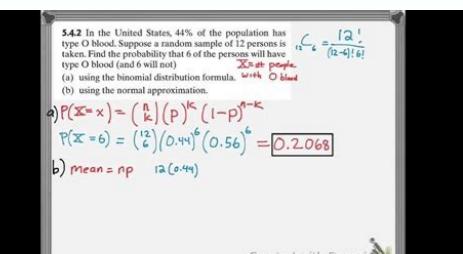
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Solution The PMF of X is given by \begin{equation} onumber P_X(k) = \left\{ \begin{array}{ll} pq^{k-1} & \quad \text{for } k=1,2,3,...\\ 0 & \quad \text{otherwise} \end{array} \right. You can find EX^2 directly using LOTUS; however, it is a little easier to find $E[X(X-1)]$ first. \end{equation} Then, we can write $$X=X_1+X_2+\cdots+X_k$$ Thus, $$EX=EX_1+EX_2+\cdots+EX_k$$ To find $P(X_i=1)$, we note that for any particular X_i all marbles are equally likely to be chosen. \end{equation} Problem Let X \sim Geometric(p)$. Find Var$(X)$ and Var(Y). Solution First note that we can prove $k (n \choose k) =n {n-1 \choose k-1}$ by the following combinatorial interpretation: Suppose that from a group of n students we would like to choose a committee of k students, one of whom is chosen to be the committee chair. \end{equation} where $q=1-p$. You have a bag that contains b blue marbles and r red marbles. Using LOTUS, we have $$EX^2 = 0^2 (0.1)+ 1^2(0.4)+2^2(0.3)+3^2(0.2)=3.4$$ Thus, we have $$\textrm{Var}(X)= (3.4)-(1.6)^2=0.84$$ Again, using LOTUS, we have $$E(X-2)^2 = (0-2)^2 (0.1)+ (1-2)^2(0.4)+(2-2)^2(0.3)+(3-2)^2(0.2)=1.$$ Problem Let X be a discrete random variable with PMF \begin{equation} onumber P_X(k) = \left\{ \begin{array}{ll} 0.2 & \quad \text{for } k=0\\ 0.2 & \quad \text{for } k=1\\ 0.3 & \quad \text{for } k=2\\ 0.3 & \quad \text{for } k=3\\ 0 & \quad \text{otherwise} \end{array} \right. \end{equation} Find and plot the CDF of X. Thus, $EX^2=\lambda^2+\lambda$ and we conclude $\textrm{Var}(X)$ $=EX^2-(EX)^2$ $=\lambda^2+\lambda-\lambda^2$ $=\lambda$. Prove $$EX=\sum_{k=0}^{\infty} P(X>k)$$ Solution Note that $P(X > 0)$ $=P_X(1)+P_X(2)+P_X(3)+P_X(4)+\cdots$, $P(X > 2)$ $=P_X(3)+P_X(4)+ P_X(5)+\cdots$. Thus, $P_Y(0)$ $=P(Y=0)=P\big(X=0) \textrm{ or } (X=1) \textrm{ or } (X=2)\big)$ $=P_X(0)+P_X(1)+P_X(2)=0.7$; $P_Y(6)$ $= P(X=3)=0.3$ Thus, $ Car$. $ 9 =) Y2 + X ($ RAV DNA $ 6 =) Y5-X2 ($ RAV Wonk EW Taht Esoppus .Selbairav Modnar Tnednepedni ERA s Y2 $ DNA $ x $, Osla. $ 2 ^ Adbmal -2 ^ Car =) X ($ rav suht, $ adbmal = car $ wonk ydaerla ew noitulos .eipmas ruoy ni selbram eulb fo rebmun eht eb $ x $ tel dna) tnemecalper tuohtiw (modnar ta selbram $ r + b gel k $ esoohc uoy . $)) B, K (NIM, ..., 2 + b, 1 + b, 0 (XAM,) RK, 0 (xam {= x r $ EREHW) noitauqe {dne. $) k x (x_p k x} x_r ni k_x {_mus = $ gnisu yltcerid $ car $ dnif, won .thgir} yarra {dne} {{txet} {txet Eulb Si Elbram Nesohc HT $ i $ EHT FI {TXET DAQ &} 1] ll {} yarra {nigeb {tfel = i x rebmuno} noitauqe {nigeb: swollof sa $ i_x $ SELBAIV MODNAR Rotacidni EHT enifed s' TEL, RALUCITRAP NI. $) X ($ RAV DNIF, $) ADBMAL (NOSSIP MIS x $ fi Melborp .Noitatcepxe FO Ytiraenil Si Evah EW Taht Loot Lufrewop A, Ralucitrap Ni. $) 2-x () 1-x (X = y $ enifed} noitauqe {dne .thgir} yarra {dne} esiwrehto {txet dauQ & 0 x_r ni x} ROF {txet dauq &}} k esoohc r + b {{}} xk esoohc r {} x esoohc b {{carF} ll {} yarra {nigeb {tfel = i x (x_p rebmuno} {nigeb yb nevig si $ x $ fo fmp eht noitulos .selbairav mods $) p (illuonreB $ $ n $ fo mus eht sa $ x $ gnitirw yb Siht Dnuof EW. $) P, N (Laimonib MIS x $ ROF $ car $ dnif s'tel, won $$.} 1-k esoohc 1-n {n =} k esoohc n {k $$ edulcnoc EW, SUHT. $ 2 ^ Car $ DNIF OT DEEN EW SUHT. $ 1 $ OT LAQE SI ENNEH, NOATBIRTSID $) P, 1-N (LAIMONIB $ SAH TAHT $ Y $ ELBAIRAV MODNAR A ROF $) L (Y_P} 1-n (^} 0 = l {_mus eht esuiceh eurt si enil tsal eht taht eton. $ car $ dnif} noitauqe {dne .Selbairav mods tnednepedni era $ y- $ dna $ x2 $ neht, selbairav mods tnednepedni era $ y $ dna $ x $ eNIS. $$) . } yarra {dne} esiwrehto {txet dauq & 0 6 = k} ROF {txet {{} yarra {nigeb {tfel = k (Y_P Rebmuno FMP gniwollof eht htiw elbairav modnar etercsid a Eb $ X $ Tel melborP x} rof {txet \ dauq \ & 0) ll {} yarra {nigeb \ {\ tfel \ =) x (X_F rebmuno} noitauqe {nigeb \ evah EW. $ Ye $ DNIF, $ 2 ^) 2-x (= k _ {_mus = $ } kn {^ qk ^ p} k esoohc \n {k NUMBER P_X (K) = \left {\ \start {array} {ll} 0.1 & \quad \text {for} k = 0 \\ 0.4 & \quad \text {for} k = 1 \\ 0.3 & \quad \text {for} k = 2 \\ 0.2 & \quad \text {for} k = 3 \\ 0 & \quad \text \end \end {array} \right. Find $ e \ on the left [\ Frac {1} {2 ^ x} \right] $. To do so, let's remember the random experiment behind the hypergeometric distribution. In particular, using Lotus we have $ E [X (X-1)] $ $ = \ Sum _{K = 0} ^ {\ InTy} K (K-1) P_X (K) $ $ = \ Sum _{K = 0} ^ {\ Infty} K (K-1) E ^ \ Lambda \ Crac {\ Lambda ^ k} {k!} $ $ = E ^ {\lambda} \ Sum _{K = 2} ^ {\ InTy} \ Frac {\ Lambda ^ k} {(K-2)!} $ $ = EB α ^ 2 \ Sum _{K = 2} ^ \ Topy} \ Frac {\ Lambda ^ ^ {K-2}} {(K-2)!} $ = E ^ \ lambda ^ 2 E ^ \ lambda $ = λ ^ 2. Problem Let $ X $ and $ and $ are two independent random variables. This is due to the symmetry: it is not more likely to be chosen a harm that is chosen than the MARMOL of $ 1 $ TH as other marbles. Therefore $ \ sum _{k = 0} ^ {\ infty} p (x> k) $ = {r (x> 0) + p (x> 1) + p (x> 2) + ... $ $ = P x (1) + 2p_x (2) + 3p_x (3) + 4p_x (4) + ... $ $ = for $. Therefore, $ e \ left [\ frac {1} {2 ^ x} \ right] $ $ = \ Sum _{K = 1} ^ {\ InTy} \ Frac {1} {2 ^ K} P_X (K) $ $ = \ SUM _{K = 1} ^ {\ InTy} \ Frac {1} {K-1} P $ = \ Frac {P} {2} \ Sum _{K = 1} ^ {\ InTy} \ Left (\ Frac {Q} {2} \ Right) ^ {K-1} $ = \ Frac {2} \ Frac {1} {1- \ Frac {Q} {2}} $ = \ Frac {P} {1 + Q} $. 3.2.5 Resolved problems: more about the problem of discrete random variables. Allow $ X $ a discrete random variable with the following PMF \ Start {Equation} Number p_x (x) = \ left {\ start {array} {ll} 0.3 & \quad \ text {for} x = 3 \\ 0.2 & \quad \ text {for} x = 5 \\ 0.3 & \quad \ text {for} x = 8 \\ 0.2 & \quad \ text .$.$ }1-K.$ }1-k ajile \ 1-n{ n = }k rigele \ n{ k $ esu :aicnereguS $ \ )6,0{ \\\ _ \\\ \ 3,2,1,0{ \ ni \ x })2-X( )1-X(\ = Y_R $ euq atneuc ne agnet ,oremirP n³AiculoS ,ahcereD \ }yarrA{ nif \ )oirartnoc ol ed{ otxet \ dauq \ & 0 \\ 01 = x

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The probability of success over a short interval must equal the probability of success over a longer interval. 3. 2022. 1. 18. · 4.1 Probability Distribution Function (PDF) for a Discrete Random Variable; 4.2 Mean or Expected Value and Standard Deviation; 4.3 Binomial Distribution; 4.4 Geometric Distribution; 4.5 Hypergeometric Distribution; 4.6 Poisson Distribution; 4.7 Discrete Distribution (Playing Card Experiment) 4.8 Discrete Distribution (Lucky Dice Experiment) Key ... 2022. 2. 6. · In probability theory and statistics, the binomial distribution is the discrete probability distribution that gives only two possible results in an experiment, either Success or Failure.For example, if we toss a coin, there could be only two possible outcomes: heads or tails, and if any test is taken, then there could be only two results: pass or fail. 2021. 2. 19. · We will also see some previous GATE problems. Next, we'll see some problems based on counting and some problems based on coefficient extraction. REFERENCES: Kenneth H Rosen: Discrete Mathematics and Its Applications 6 th [Chapter 2.4, 6.4] 2 · In probability theory and statistics, the beta distribution is a family of continuous probability distributions defined on the interval [0, 1] parameterized by two positive shape parameters, denoted by α and β, that appear as exponents of the random variable and control the shape of the distribution.The generalization to multiple variables is called a Dirichlet distribution. Negative Binomial Probability. The negative binomial probability refers to the probability of getting the second head on the fifth flip of the coin is 0.078125. 2020. 9. 25. · 00:36:08 – Find the probability of failure (Example #5) 00:39:15 – Find mean, standard deviation and probability for the distribution (Example #6) 00:45:42 – Find the probability using the negative binomial and binomial distribution (Example #7) Practice Problems with Step-by-Step Solutions ; Chapter Tests with Video Solutions statistics - statistics - Random variables and probability distributions: A random variable is a numerical description of the outcome of a statistical experiment. A random variable that may assume only a finite number or an infinite sequence of values is said to be discrete; one that may assume any value in some interval on the real number line is said to be continuous. 2 · In Probability and Statistics, the Cumulative Distribution Function (CDF) of a real-valued random variable, say "X", which is evaluated at x, is the probability that X takes a value less than or equal to the x. A random variable is a variable that defines the possible outcome values of an unexpected phenomenon. It is defined for both discrete and random variables. 2022. 1. 24. · Our 1000+ Probability and Statistics MCQs (Multiple Choice Questions and Answers) focuses on all chapters of Probability and Statistics covering 100+ topics. You should practice these MCQs for 1 hour daily for 2-3 months. This way of systematic learning will prepare you easily for Probability and Statistics exams, contests, online tests, quizzes, MCQ-tests, viva .... It would be the probability that the coin flip experiment results in zero heads plus the probability that the experiment results in one head. P(X < 1) = P(X = 0) + P(X = 1) = 0.25 + 0.50 = 0.75. Like a probability distribution, a cumulative probability distribution ... Probability Distribution Questions and Answers Test your understanding with practice problems and step-by-step solutions. Browse through all study tools. Statistics and Probability Problems Mean and Standard deviation - Problems with Solutions.Mean and standard deviation problems are presented. Problems related to data sets as well as grouped data are discussed. Statistics and Probability Problems with Answers - sample 1: mean, mode, standard deviation, quartiles, frequency distribution of qualitative data. These lessons, with videos, examples and step-by-step solutions, are suitable for A Level Maths students learning. how to construct a probability distribution table for a discrete random variable, how to calculate probabilities from a probability distribution table for a discrete random variable, 2020. 9. 25. · A discrete probability distribution lists all the possible values that the random variable can assume and their corresponding probabilities. ... Practice Problems with Step-by-Step Solutions ; Chapter Tests with Video Solutions ; Get access to all the courses and over 450 HD videos with your subscription. 27: Discrete Probability Distributions 28: Probability Histograms 29: Mean and Expected Value of Discrete Random Variables 30: Variance and Standard Deviation of Discrete Random Variables 31: The Law Of Large Numbers 32: Binomial Distribution 33: Mean And Standard Deviation Of Binomial Random Variables 34: Poisson Distribution/Process

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