

Specifically, what is the largest ^{possible} value of $P(X \geq a)$ while keeping the same mean value say $a = 3$ say $m = 5$

Ans:

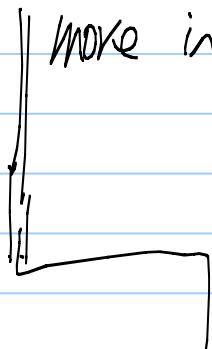
Pf:

(3)

Inequality

A refinement
of the Markov Inequality, which gives you
more accurate estimate at the price of requiring

MORE info. Need:



Ex: I am recording the values of my stock portfolio, which has 100 stocks.

One day my computer crashes,
I only remember the average price is

50.

Q: At most how many stocks can have
the price > 90 ?

Ans:

Q: Suppose I also remember the standard deviation is 20.

What is the maximum number of stocks having value ≥ 90 .

Ans:

Q: Suppose I also know it is a bell-shaped distribution
What is $P(X > 90)$?

Ans:

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Inequality: A further refinement
of the Markov inequality
We need only

Chernoff Inequality.

* Continue from our example. For a
Gsr w. $\mu=50$, $\sigma=20$, $a=90$
 $X^*(s) = e^{-s\cdot \mu + \frac{\sigma^2 s^2}{2}}$

Pf of the Chernoff bound.

* Chernoff bound is tricky.

Since once knowing $X^*(s)$, we already know the exact distribution of X . We can thus use summation/integration to find the "exact" value of $P(X \geq a)$. However, finding the exact value of $P(X \geq a)$ is computationally intensive. In many cases, find the Chernoff bound value is just as good.

Chapter 5 Pairs of R.V.s.

Consider a R.V X with sample space $S_x = \{0, 1\}$ and another R.V Y with $S_y = \{0, 1, 2\}$.

To discuss the joint relationship of X and Y , we need to consider the []

Once the W.A of S_{xy} is made,

We can compute any prob like

$$P(X^2 \leq Y), P(\max(X, Y) \leq 3) \dots$$

Note that

$$\text{Even } E(X^2 Y)$$

It is no different than considering

a Random Vector $W = (X, Y)$ where

the output of each W is a vector.

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Nonetheless, it is not efficient to always assign the weight for the joint sample space as most of the time, we are interested only in $P(X > 0)$, $P(\sqrt{X} < 3)$

$E(X^{\frac{3}{2}})$. In most cases, we do the W.A gradually, start from the W.A of X , then extend to (X, Y) . We say the W.A for X alone is

the

		0	1	2
X	0	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
	1	$\frac{1}{4}$	0	$\frac{1}{4}$

joint distribution

the key concept of every iteration

Note 1: marginal + marginal \Rightarrow joint.

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		Y		
		0	1	>
X	0	5/24	2/24	5/24
	1	5/24	2/24	5/24

has the same marginal distributions as the first example. but different joint distribution.

Ex HW10Q8

X is geometric with p.

\rightarrow The marginal distribution

Given $X = X_0$, Y is a Poisson with

$$\lambda = X_0$$

\rightarrow The conditional distribution

Q: The joint sample space = ?

Ans:

Q: What is the joint W.A?