Note Title 3/2/2011

Specifically, what is ~~the~~ largest possible value of $P(X \geq a)$ while keeping the same mean value $E(X) = m$

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:

Note Title 3/7/2011

④ $\boxed{\text{Inequality}}$: A further refinement of the Markov inequality

We need only

Chernoff Inequality.

* Continue from our example. For a Gsn 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.Vs.

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

$P(X^2 \leq \sqrt{Y})$, $P(\max(X, Y) \leq 3)$ . . . . Even $E(X^2 Y)$

Note that

It is no different than considering a Random Vector $W = (X, Y)$ where the output of each W is a vector.

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 $\boxed{}$

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

$\boxed{\text{joint distribution}}$

the key concept of every imputation

Note 1: marginal + marginal $\not\Rightarrow$ joint.

Ex

$X \backslash Y$	0	1	2
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.

$\longrightarrow$ The marginal distribution

Given $X = x_0$, Y is a Poisson with $\alpha = x_0$

$\longrightarrow$ The conditional distribution

Q: The joint sample space = ?

Ans:

Q: What is the joint W.A ?