Topics3

Saturday, February 20, 2021 8:55 PM

Math (Derivation).	Application
Bernoulli.	in R *.

Ex: coin toss,

Prob. Mass Fct: (X is discrete)

$P(X) = \begin{cases} p & \text{if } x=1 \\ 1-p & \text{if } x=0. \end{cases}$ ✓

✓ $\mathbb{E}X = \sum_{x\in(1,0)} x \cdot P(X) = \cdots = p$ ✓

✓ $var(X) = \mathbb{E}X^2 - \mathbb{E}X = p(1-p)$.

$\mathbb{E}X^2 = \sum x^2 \cdot P(x) = \cdots = p^2$ ✓

1st Mom. $\mathbb{E}X$: expectation. mean. average of X

2nd Mom. $\mathbb{E}X^2$:

⋮

kth Mom: $\mathbb{E}X^k$: (?)

Mom. Gen. Fct:

$M_X(t) = \mathbb{E}(\exp(tX))$. ← funct of. t. and X

$= \sum \exp(tX) \cdot p(x)$ ↖ Prob. Mass Fct

↑ whatever is $\mathbb{E}(\cdot)$

$= \cdots$

$= 1 - p + p\exp(t)$

kth mom: $\left(\frac{\partial}{\partial t}\right)^k M_X(t) \Big|_{t=0}$

$k=1$. $\mathbb{E}X^1 = \mathbb{E}X = pe^t \Big|_{t=0} = pe^0 = p$

Ex: 3rd: Skewness ← for (option pricing)
4th: Kurtosis ←
⋮
higher order: k^{th} ← entropy (Machine Learning)
general

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uniform.

$\mathbb{E}X$. ✓

$\mathbb{E}X^2$ ✓

$Var(X) = \mathbb{E}X^2 - \mathbb{E}X$ ✓

MGF = ?

(Math)		(Application)
Bernoulli	→	Portfolio: What is best weight? Optimal allocation?
Uniform	→	How to visualize P_i?

Start with a unit Square
↑ using Unif. R.V.

Capstone?

(• : Portfolio:) → multiple stocks
→ allow short selling.
→ ..
↑ add ETF

* If you're interested in multiple stocks:

Create a function that download 3 stocks;
you can set it up so people can enter whatever they like.

then compute:
- given w_A, w_B, w_B.
- Compute:

$\mathbb{E}(return)$

$Var(return)$

Simulation:
You want to search over a grid of 3 vectors;

1%	1%	98%
1%	2%	97%
⋮	⋮	⋮

until you find the best Combination.!