Gamma distribution

PDF

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for all , and

Proof:

The article also simply says the fact:

one can directly use definition of gamma function to prove it.

See

[Probability density function of the gamma distribution | The Book of Statistical Proofs (statproofbook.github.io)](https://statproofbook.github.io/P/gam-pdf)

CDF

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If it is a Erlang distribution (with is a positive integer). Then

Proof:

See

[Cumulative distribution function of the gamma distribution | The Book of Statistical Proofs (statproofbook.github.io)](https://statproofbook.github.io/P/gam-cdf.html#:~:text=Proof%3A%20The%20probability%20density%20function%20of%20the%20gamma,a%20%E2%88%92%201%20exp%20%5B%20%E2%88%92%20b%20x%5D.)

Expected Value

Proof:

Sorry, I forgot to write dx in integral, it’s my fault.

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(since gamma distribution is only defined on nonnegative real number.

We consider PDF of gamma distribution is 0 for all X < 0 )

With PDF, we have that

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Employ the property of gamma function. We have that

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For more details, see

[Mean of the gamma distribution | The Book of Statistical Proofs (statproofbook.github.io)](https://statproofbook.github.io/P/gam-mean)

Variance

Proof:

Sorry, again, I forgot to write dx in integral at first two equations. It’s my fault.

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With PDF, we have that

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Employ the property of gamma function twice. We have that

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Again, with PDF, we can simplify it as:

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For more details, see

[Variance of the gamma distribution | The Book of Statistical Proofs (statproofbook.github.io)](https://statproofbook.github.io/P/gam-var)

Median (Approximation)

It has no closed-form. Thus, it can NOT be evaluated.

The approximation value of median of X in Gamma distribution is

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(since the integral of that from –inf to 0 and from v to inf is always 0)

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Proof:

Skip

Bound

Proof:

Skip

Skewness

Moments

Ref

[Gamma distribution - Wikipedia](https://en.wikipedia.org/wiki/Gamma_distribution)