Uniform Probability Distribution

Animal Health Risk Analysis
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Analyse des risques de la santé des animaux
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Canadian Food Inspection Agency (CFIA)

Agence canadienne d'inspection des aliments (ACIA)

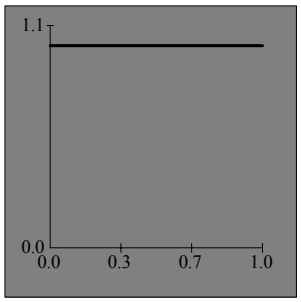
Properties of the Uniform Distribution

The uniform or rectangular continuous distribution is a special case of the beta distribution. The uniform is a very simple distribution, requiring an assumption about the range of possible values. The uniform is useful for representing subjective judgements about uncertainty when an expert is only willing to estimate an upper and lower bound for a quantity.

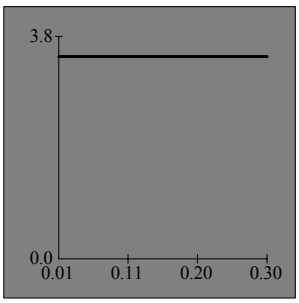
A variation of the uniform distribution is the loguniform, useful in cases where inputs cover large ranges of values, but little is known about their underlying distribution. In a loguniform distribution, the logtransformed random variable is assumed to be uniformly distributed. The mean and variance of the loguniform are:

$$\frac{(\ln(a) + \ln(b))}{2}, \frac{(\ln(\frac{b}{a}))^2}{12}$$

Uniform or rectangular variate Uniform (0,1) is identical to the beta variate β (1, 1).



Uniform or rectangular variate Uniform (0.01,0.3)



Properties of the Uniform Distribution

Probability density function:

$$f(x) = \frac{1}{(b-a)}, a = \min imum, b = \max imum$$

Cumulative distribution function:

$$F(x) = \frac{(x-a)}{(b-a)}$$

Parameters: a < b. The minimum (a) represents the location parameter.

Domain: minimum ≤ x ≤ maximum

Mean (μ): (a + b)/2

Variance (σ^2): $\frac{(b-a)^2}{12}$

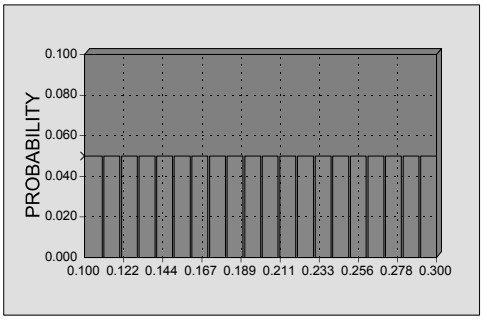
Mode: no unique mode

Coefficient of skewness (α3): 0

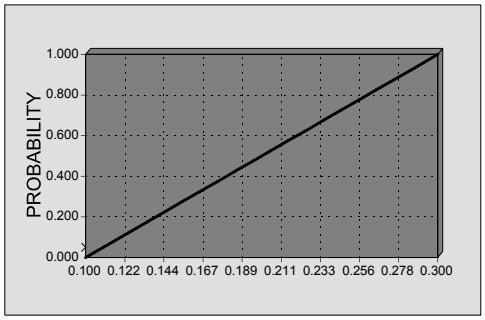
Coefficient of kurtosis (α4): 9/5

Properties of the Uniform Distribution

Probability density function for Uniform (0.1, 0.3) as an output of @RISK simulation



Cumulative distribution function for Uniform (0.1, 0.3) as an output of @RISK simulation



Duration of Pseudorabies Viraemia Example

Nasal virus excretion occurs for 8-17 days with maximum titres between $10^{5.8}$ and $10^{8.3}$ $TCID_{50}$. From oropharyngeal swabs it can be isolated for 18-25 days with titres up to 10^{6} $TCID_{50}$. Virus is also excreted in vaginal and foreskin secretions up to 12 days and in milk for 2-3 days .

The evidence above was interpreted into a uniform distribution with minimum and maximum parameters (18, 25).

First Day of Pseudorabies Viraemia Example

The age at slaughter of hogs in the USA was estimated at 176.4 days ± 1.0 standard error (pig average) while the weaning age population estimate was 25.7± 0.5 (pig average). Equal likelihood of pseudorabies viral exposure for any time interval between weaning and slaughter was considered. More than one pseudorabies viral expesure and infection during a pig's lifespan from weaning to marketing was not considered. A uniform distribution was employed to represent the first day of viraemia in infected hogs. The @RISK software function was set up as follows:

=RiskUniform(RiskNormal(25.7, 0.5), RiskNormal(176.4, 1)).