

```
> restart;
read("c:/appl/appl7.txt");
```

PROCEDURES:

AllPermutations(n), AllCombinations(n, k), Benford(X), BootstrapRV(Data),
CDF:CHF:HF:IDF:PDF:SF(X, [x]), CoefOfVar(X), Convolution(X, Y),
ConvolutionIID(X, n), CriticalPoint(X, prob), Determinant(MATRIX), Difference(X, Y),
Display(X), ExpectedValue(X, [g]), KSTest(X, Data, Parameters), Kurtosis(X),
Maximum(X, Y), MaximumIID(X, n), Mean(X), MGF(X), Minimum(X, Y),
MinimumIID(X, n), Mixture(MixParameters, MixRVs),
MLE(X, Data, Parameters, [Rightcensor]), MLENHPP(X, Data, Parameters, obstime),
MLEWeibull(Data, [Rightcensor]), MOM(X, Data, Parameters),
NextCombination(Previous, size), NextPermutation(Previous), OrderStat(X, n, r, ["wo"]),
PlotDist(X, [low], [high]), PlotEmpCDF(Data, [low], [high]),
PlotEmpCIF(Data, [low], [high]), PlotEmpSF(Data, Censor),
PlotEmpVsFittedCDF(X, Data, Parameters, [low], [high]),
PlotEmpVsFittedCDF(X, Data, Parameters, [low], [high]),
PlotEmpVsFittedSF(X, Data, Parameters, Censor, low, high),
PPPlot(X, Data, Parameters), Product(X, Y), ProductIID(X, n),
QQPlot(X, Data, Parameters), RangeStat(X, n, ["wo"]), Skewness(X), Transform(X, g),
Truncate(X, low, high), Variance(X), VerifyPDF(X)

Procedure Notation:

X and Y are random variables

Greek letters are numeric or symbolic parameters

x is numeric or symbolic

n and r are positive integers, $n \geq r$

low and high are numeric

g is a function

Brackets [] denote optional parameters

"double quotes" denote character strings

MATRIX is a 2 x 2 array of random variables

*A capitalized parameter indicates that it must be
entered as a list --> ex. Data := [1, 12.4, 34, 52.45, 63]*

Variate Generation:

ArcTanVariate(alpha, phi), BinomialVariate(n, p, m), ExponentialVariate(lambda),
NormalVariate(mu, sigma), UniformVariate(), WeibullVariate(lambda, kappa, m)

DATA SETS:

BallBearing, HorseKickFatalities, Hurricane, MP6, RatControl, RatTreatment, USSHalfBeak

ArcSinRV(), ArcTanRV(alpha, phi), BetaRV(alpha, beta), CauchyRV(a, alpha), ChiRV(n),

*ChiSquareRV(n), ErlangRV(lambda, n), ErrorRV(mu, alpha, d), ExponentialRV(lambda),
 ExponentialPowerRV(lambda, kappa), ExtremeValueRV(alpha, beta), FRV(n1, n2),
 GammaRV(lambda, kappa), GeneralizedParetoRV(gamma, delta, kappa),
 GompertzRV(delta, kappa), HyperbolicSecantRV(), HyperExponentialRV(p, l),
 HypoExponentialRV(l), IDBRV(gamma, delta, kappa), InverseGaussianRV(lambda, mu),
 InvertedGammaRV(alpha, beta), KSRV(n), LaPlaceRV(omega, theta),
 LogGammaRV(alpha, beta), LogisticRV(kappa, lambda), LogLogisticRV(lambda, kappa),
 LogNormalRV(mu, sigma), LomaxRV(kappa, lambda), MakehamRV(gamma, delta, kappa),
 MuthRV(kappa), NormalRV(mu, sigma), ParetoRV(lambda, kappa), RayleighRV(lambda),
 StandardCauchyRV(), StandardNormalRV(), StandardTriangularRV(m),
 StandardUniformRV(), TRV(n), TriangularRV(a, m, b), UniformRV(a, b),
 WeibullRV(lambda, kappa)*

Error, attempting to assign to `DataSets` which is protected.
 Try declaring `local DataSets`; see ?protect for details.

```

> bf := RayleighRV(a);
  bfname := "RayleighRV(a)";
Originally a, renamed a~:
  is assumed to be: RealRange(Open(0),infinity)

```

$$bf := \left[\left[x \rightarrow 2 a^2 x e^{-a^2 x^2} \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$bfname := "RayleighRV(a)"$

(1)

```

> #plot(1/csch(t)+1, t = 0..0.0010);
  #plot(diff(1/csch(t),t), t=0..0.0010);
  #limit(1/csch(t), t=0);
> solve(exp(-t) = y, t);

```

$$-\ln(y)$$

(2)

```

> # discarded -ln(t + 1), t-> csch(t), t->arccsch(t), t -> tan(t),
> #name of the file for latex output
  filename := "C:/Latex_Output_2/Rayleigh_Gen.tex";

```

```

glist := [t -> t^2, t -> sqrt(t), t -> 1/t, t -> arctan(t), t
-> exp(t), t -> ln(t), t -> exp(-t), t -> -ln(t), t -> ln(t+1),
t -> 1/(ln(t+2)), t -> tanh(t), t -> sinh(t), t -> arcsinh(t),
t-> csch(t+1), t->arccsch(t+1), t-> 1/tanh(t+1), t-> 1/sinh(t+1),
t-> 1/arcsinh(t+1), t-> 1/csch(t)+1, t-> tanh(1/t), t->csch
(1/t), t-> arccsch(1/t), t-> arctanh(1/t) ]:

```

```

base := t -> PDF(bf, t):

```

```

print(base(x)):

```

```

#begin latex file formatting
appendto(filename);
  printf("\documentclass[12pt]{article} \n");

```

```

printf("\\usepackage{amsfonts} \n");
printf("\\begin{document} \n");
print(bfname);
printf("$");
latex(bf[1]);
printf("$");
writeto(terminal);

#begin loopint through transformations
for i from 1 to 22 do
#for i from 1 to 3 do
    print( "i is", i, " -----"
-----" );

    g := glist[i];
    l := bf[2][1];
    u := bf[2][2];
    Temp := Transform(bf, [[unapply(g(x), x)], [l,u]]);

#terminal output
print( "l and u", l, u );
print("g(x)", g(x), "base", base(x), bfname);
print("f(x)", PDF(Temp, x));

#latex output
appendto(filename);
printf("----- \\\");
printf("$");
latex(glist[i]);
printf("$");
printf("Probability Distribution Function \n$ f(x)=");
latex(PDF(Temp,x));
printf(" \\\quad");
latex(Temp[2][1]);
printf(" < x < ");
latex(Temp[2][2]);
printf("$");

writeto(terminal);

od;

#final latex output
appendto(filename);
printf("\\end{document}\n");
writeto(terminal);

```

filename := "C:/Latex_Output_2/Rayleigh_Gen.tex"

$$2 a^2 x e^{-a^2 x^2}$$

"i is", 1,

"-----"

$$g := t \rightarrow t^2$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow a^2 e^{-a^2 y} \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", x^2, "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", a^2 e^{-a^2 x}$$

"i is", 2,

"-----"

$$g := t \rightarrow \sqrt{t}$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow 4 a^2 y^3 e^{-a^2 y^4} \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \sqrt{x}, "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", 4 a^2 x^3 e^{-a^2 x^4}$$

"i is", 3,

"-----"

$$g := t \rightarrow \frac{1}{t}$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow \frac{2 a^2 e^{-\frac{a^2}{y^2}}}{y^3} \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \frac{1}{x}, "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", \frac{2 a^2 e^{-\frac{a^2}{x^2}}}{x^3}$$

"i is", 4,

"-----"

-----"

$$g := t \rightarrow \arctan(t)$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \sim \rightarrow \frac{2 a^2 \sin(y) e^{-\frac{a^2 \sin(y)^2}{\cos(y)^2}}}{\cos(y)^3} \right], \left[0, \frac{1}{2} \pi \right], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \arctan(x), "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", \frac{2 a^2 \sin(x) e^{-\frac{a^2 \sin(x)^2}{\cos(x)^2}}}{\cos(x)^3}$$

"i is", 5,

"

-----"

$$g := t \rightarrow e^t$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \sim \rightarrow \frac{2 a^2 \ln(y) e^{-a^2 \ln(y)^2}}{y} \right], [1, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", e^x, "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", \frac{2 a^2 \ln(x) e^{-a^2 \ln(x)^2}}{x}$$

"i is", 6,

"

-----"

$$g := t \rightarrow \ln(t)$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \sim \rightarrow 2 a^2 e^{2y} - a^2 e^{2y} \right], [-\infty, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \ln(x), "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", 2 a^2 e^{2x - a^2 e^{2x}}$$

"i is", 7,

"

-----"

$$g := t \rightarrow e^{-t}$$

$$l := 0$$

["Continuous", "PDF"]

"l and u", 0, ∞

"g(x)", $\frac{1}{\ln(x+2)}$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $\frac{2 a^2 \left(e^{\frac{1}{x}} - 2 \right) e^{-\frac{\frac{2}{e^{\frac{1}{x}} a^2 x - 4 e^{\frac{1}{x}} a^2 x + 4 a^2 x - 1}}{x}}}{x^2}$

"i is", 11,

"-----"
 -----"

$g := t \rightarrow \tanh(t)$

$l := 0$

$u := \infty$

$Temp := \left[\left[y \rightarrow -\frac{2 a^2 \operatorname{arctanh}(y) e^{-a^2 \operatorname{arctanh}(y)^2}}{y^2 - 1} \right], [0, 1], ["Continuous", "PDF"] \right]$

"l and u", 0, ∞

"g(x)", $\tanh(x)$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $-\frac{2 a^2 \operatorname{arctanh}(x) e^{-a^2 \operatorname{arctanh}(x)^2}}{x^2 - 1}$

"i is", 12,

"-----"
 -----"

$g := t \rightarrow \sinh(t)$

$l := 0$

$u := \infty$

$Temp := \left[\left[y \rightarrow \frac{2 a^2 \operatorname{arcsinh}(y) e^{-a^2 \operatorname{arcsinh}(y)^2}}{\sqrt{y^2 + 1}} \right], [0, \infty], ["Continuous", "PDF"] \right]$

"l and u", 0, ∞

"g(x)", $\sinh(x)$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $\frac{2 a^2 \operatorname{arcsinh}(x) e^{-a^2 \operatorname{arcsinh}(x)^2}}{\sqrt{x^2 + 1}}$

"i is", 13,

"-----"
 -----"

$g := t \rightarrow \operatorname{arcsinh}(t)$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow 2 a^2 \sinh(y) e^{-a^2 \sinh(y)^2} \cosh(y) \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \operatorname{arcsinh}(x), "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", 2 a^2 \sinh(x) e^{-a^2 \sinh(x)^2} \cosh(x)$$

"i is", 14,

"-----"
 -----"

$$g := t \rightarrow \operatorname{csch}(t + 1)$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow \frac{2 a^2 (-1 + \operatorname{arccsch}(y)) e^{-a^2 (-1 + \operatorname{arccsch}(y))^2}}{\sqrt{y^2 + 1} |y|} \right], \left[0, \frac{2}{e - e^{-1}} \right], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \operatorname{csch}(x + 1), "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", \frac{2 a^2 (-1 + \operatorname{arccsch}(x)) e^{-a^2 (-1 + \operatorname{arccsch}(x))^2}}{\sqrt{x^2 + 1} |x|}$$

"i is", 15,

"-----"
 -----"

$$g := t \rightarrow \operatorname{arccsch}(t + 1)$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow -\frac{2 a^2 (\sinh(y) - 1) e^{-\frac{a^2 (\sinh(y) - 1)^2}{\sinh(y)^2}} \cosh(y)}{\sinh(y)^3} \right], [0, \ln(1 + \sqrt{2})], ["Continuous", "PDF"] \right]$$

$$"l \text{ and } u", 0, \infty$$

$$"g(x)", \operatorname{arccsch}(x + 1), "base", 2 a^2 x e^{-a^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", -\frac{2 a^2 (\sinh(x) - 1) e^{-\frac{a^2 (\sinh(x) - 1)^2}{\sinh(x)^2}} \cosh(x)}{\sinh(x)^3}$$

"i is", 16,

"-----"
-----"

$$g := t \rightarrow \frac{1}{\tanh(t + 1)}$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow \frac{2 a^2 \left(-1 + \operatorname{arctanh}\left(\frac{1}{y}\right) \right) e^{-a^2 \left(-1 + \operatorname{arctanh}\left(\frac{1}{y}\right) \right)^2}}{y^2 - 1} \right], \left[1, \frac{e + e^{-1}}{e - e^{-1}} \right], \right. \\ \left. ["Continuous", "PDF"] \right]$$

"l and u", 0, ∞

$$\text{"g(x)", } \frac{1}{\tanh(x + 1)}, \text{"base", } 2 a^2 x e^{-a^2 x^2}, \text{"RayleighRV(a)"}$$

$$\text{"f(x)", } \frac{2 a^2 \left(-1 + \operatorname{arctanh}\left(\frac{1}{x}\right) \right) e^{-a^2 \left(-1 + \operatorname{arctanh}\left(\frac{1}{x}\right) \right)^2}}{x^2 - 1}$$

"i is", 17,

"-----"
-----"

$$g := t \rightarrow \frac{1}{\sinh(t + 1)}$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \rightarrow \frac{2 a^2 \left(-1 + \operatorname{arcsinh}\left(\frac{1}{y}\right) \right) e^{-a^2 \left(-1 + \operatorname{arcsinh}\left(\frac{1}{y}\right) \right)^2}}{\sqrt{y^2 + 1} |y|} \right], \left[0, \frac{2}{e - e^{-1}} \right], \right. \\ \left. ["Continuous", "PDF"] \right]$$

"l and u", 0, ∞

$$\text{"g(x)", } \frac{1}{\sinh(x + 1)}, \text{"base", } 2 a^2 x e^{-a^2 x^2}, \text{"RayleighRV(a)"}$$

$$\text{"f(x)", }\frac{2\,a^2\left(-1+\operatorname{arcsinh}\left(\frac{1}{x}\right)\right)\mathrm{e}^{-a^2\left(-1+\operatorname{arcsinh}\left(\frac{1}{x}\right)\right)^2}}{\sqrt{x^2+1}\,|x|}$$

"i is", 18,
 "-----"
 -----"

$$\begin{array}{l} g:=t\rightarrow \frac{1}{\operatorname{arcsinh}(t+1)} \\ l:=0 \\ u:=\infty \end{array}$$

$$Temp:=\left[\left[y\leadsto \frac{2\,a^2\left(-1+\sinh\left(\frac{1}{y\leadsto}\right)\right)\mathrm{e}^{-a^2\left(-1+\sinh\left(\frac{1}{y\leadsto}\right)\right)^2}\cosh\left(\frac{1}{y\leadsto}\right)}{y\leadsto^2}\right],\left[0,\frac{1}{\ln\left(1+\sqrt{2}\right)}\right],\left[\text{"Continuous"},\text{"PDF"}\right]\right]$$

"l and u", 0, ∞

$$\text{"g(x)", }\frac{1}{\operatorname{arcsinh}(x+1)},\text{"base", }2\,a^2x\,\mathrm{e}^{-a^2x^2},\text{"RayleighRV(a)"}$$

$$\text{"f(x)", }\frac{2\,a^2\left(-1+\sinh\left(\frac{1}{x}\right)\right)\mathrm{e}^{-a^2\left(-1+\sinh\left(\frac{1}{x}\right)\right)^2}\cosh\left(\frac{1}{x}\right)}{x^2}$$

"i is", 19,
 "-----"
 -----"

$$\begin{array}{l} g:=t\rightarrow \frac{1}{\operatorname{csch}(t)}+1 \\ l:=0 \\ u:=\infty \end{array}$$

$$Temp:=\left[\left[y\leadsto \frac{2\,a^2\operatorname{arccsch}\left(\frac{1}{y\leadsto-1}\right)\mathrm{e}^{-a^2\operatorname{arccsch}\left(\frac{1}{y\leadsto-1}\right)^2}}{\sqrt{y\leadsto^2-2\,y\leadsto+2}}\right],\left[1,\infty\right],\left[\text{"Continuous"},\text{"PDF"}\right]\right]$$

"l and u", 0, ∞

"g(x)", $\frac{1}{\operatorname{csch}(x)} + 1$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $\frac{2 a^2 \operatorname{arccsch}\left(\frac{1}{x-1}\right) e^{-a^2 \operatorname{arccsch}\left(\frac{1}{x-1}\right)^2}}{\sqrt{x^2-2 x+2}}$

"i is", 20,

"-----"
 -----"

$g := t \rightarrow \tanh\left(\frac{1}{t}\right)$

$l := 0$

$u := \infty$

$Temp := \left[\left[y \rightarrow -\frac{2 a^2 e^{-\frac{a^2}{\operatorname{arctanh}(y)^2}}}{\operatorname{arctanh}(y)^3 (y^2-1)} \right], [0, 1], ["Continuous", "PDF"] \right]$

"l and u", 0, ∞

"g(x)", $\tanh\left(\frac{1}{x}\right)$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $-\frac{2 a^2 e^{-\frac{a^2}{\operatorname{arctanh}(x)^2}}}{\operatorname{arctanh}(x)^3 (x^2-1)}$

"i is", 21,

"-----"
 -----"

$g := t \rightarrow \operatorname{csch}\left(\frac{1}{t}\right)$

$l := 0$

$u := \infty$

$Temp := \left[\left[y \rightarrow \frac{2 a^2 e^{-\frac{a^2}{\operatorname{arccsch}(y)^2}}}{\sqrt{y^2+1} \operatorname{arccsch}(y)^3 |y|} \right], [0, \infty], ["Continuous", "PDF"] \right]$

"l and u", 0, ∞

"g(x)", $\operatorname{csch}\left(\frac{1}{x}\right)$, "base", $2 a^2 x e^{-a^2 x^2}$, "RayleighRV(a)"

"f(x)", $\frac{2 a^2 e^{-\frac{a^2}{\operatorname{arccsch}(x)^2}}}{\sqrt{x^2+1} \operatorname{arccsch}(x)^3 |x|}$

"i is", 22,

"-----"
 -----"

$$g := t \rightarrow \operatorname{arccsch}\left(\frac{1}{t}\right)$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y \sim \rightarrow 2 a \sim^2 e^{-a \sim^2 \sinh(y \sim)^2} \cosh(y \sim) \sinh(y \sim) \right], [0, \infty], ["Continuous", "PDF"] \right]$$

$$["l \text{ and } u", 0, \infty$$

$$"g(x)", \operatorname{arccsch}\left(\frac{1}{x}\right), "base", 2 a \sim^2 x e^{-a \sim^2 x^2}, "RayleighRV(a)"$$

$$"f(x)", 2 a \sim^2 e^{-a \sim^2 \sinh(x)^2} \cosh(x) \sinh(x)$$

(3)