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

Originally b, renamed b~:
  is assumed to be: RealRange(Open(0),infinity)
```

$$bf := \left[\left[x \to \frac{a\sim b\sim (a\sim x)^{b\sim -1}}{\left(1+(a\sim x)^{b\sim}\right)^2}\right], [0, \infty], ["\text{Continuous}", "\text{PDF}"]\right]$$

$$bfname := "\text{LogLogisticRV(a,b)}" \quad (1)$$

```
> #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);
```

$$-\ln(y) \quad (2)$$

```
> # 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/LogLogistic_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$$  f(x)=");
  latex(PDF(Temp,x));
  printf(" \\qquad");
  latex(Temp[2][1]);
  printf(" < x < ");
  latex(Temp[2][2]);
  printf("$$");



  writeto(terminal);


od;

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

$$filename := \text{"C:/Latex\_Output\_2/LogLogistic\_Gen.tex"}$$

$$\frac{a{\sim}\, b{\sim}\, (a{\sim}\, x)^{b{\sim}\, -\, 1}}{\left(1 + (a{\sim}\, x)^{b{\sim}}\right)^2}$$

"i is", 1,
" --"

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

$$l := 0$$

$$u := \infty$$

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

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

$$\text{"g(x)"}, x^2, \text{"base"}, \frac{a{\sim}\, b{\sim}\, (a{\sim}\, x)^{b{\sim}\, -\, 1}}{\left(1 + (a{\sim}\, x)^{b{\sim}}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

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

"i is", 2,
" --"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y{\sim} \rightarrow \frac{2\, a{\sim}^{b{\sim}}\, b{\sim}\, \left(y{\sim}^2\right)^{b{\sim}}}{y{\sim}\, \left(1 + a{\sim}^{b{\sim}}\, \left(y{\sim}^2\right)^{b{\sim}}\right)^2}\right], [0, \infty], [\text{"Continuous"}, \text{"PDF"}]\right]$$

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

$$\text{"g(x)"}, \sqrt{x}, \text{"base"}, \frac{a{\sim}\, b{\sim}\, (a{\sim}\, x)^{b{\sim}\, -\, 1}}{\left(1 + (a{\sim}\, x)^{b{\sim}}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

$$\text{"f(x)"}, \frac{2\, a{\sim}^{b{\sim}}\, b{\sim}\, \left(x^2\right)^{b{\sim}}}{x\, \left(1 + a{\sim}^{b{\sim}}\, \left(x^2\right)^{b{\sim}}\right)^2}$$

"i is", 3,
" --"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \rightarrow \frac{a\sim^{b\sim}\, b\sim \left(\frac{1}{y\sim}\right)^{b\sim}}{y\sim \left(1 + a\sim^{b\sim} \left(\frac{1}{y\sim}\right)^{b\sim}\right)^2}\right], [0, \infty], [\text{"Continuous"}, \text{"PDF"}]\right]$$

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

$$\text{"g(x)"}, \frac{1}{x}, \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim - 1}}{\left(1 + (a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

$$\text{"f(x)"}, \frac{a\sim^{b\sim}\, b\sim \left(\frac{1}{x}\right)^{b\sim}}{x \left(1 + a\sim^{b\sim} \left(\frac{1}{x}\right)^{b\sim}\right)^2}$$

"i is", 4,

" --"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \rightarrow \frac{a\sim^{b\sim}\, b\sim \tan(y\sim)^{b\sim - 1} \left(1 + \tan(y\sim)^2\right)}{\left(1 + a\sim^{b\sim} \tan(y\sim)^{b\sim}\right)^2}\right], \left[0, \frac{1}{2}\pi\right], [\text{"Continuous"}, \text{"PDF"}]\right]$$

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

$$\text{"g(x)"}, \arctan(x), \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim - 1}}{\left(1 + (a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

$$\text{"f(x)"}, \frac{a\sim^{b\sim}\, b\sim \tan(x)^{b\sim - 1} \left(1 + \tan(x)^2\right)}{\left(1 + a\sim^{b\sim} \tan(x)^{b\sim}\right)^2}$$

"i is", 5,

" --"

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

$$l := 0$$

$$u := \infty$$

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

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

$$\text{"g(x)"}, e^x, \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim - 1}}{\left(1 + (a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

$$\text{"f(x)"}, \frac{a\sim^{b\sim}\, b\sim \ln(x)^{b\sim - 1}}{\left(1 + a\sim^{b\sim} \ln(x)^{b\sim}\right)^2 x}$$

"i is", 6,
" --
----------"

$$g := t \to \ln(t)$$
$$l := 0$$
$$u := \infty$$
$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim\, \mathrm{e}^{b\sim\, y\sim}}{\left(1 + a\sim^{b\sim}\, \mathrm{e}^{b\sim\, y\sim}\right)^2}\right], [-\infty, \infty], [\text{"Continuous"}, \text{"PDF"}]\right]$$
$$\text{"l and u"}, 0, \infty$$
$$\text{"g(x)"}, \ln(x), \text{"base"}, \frac{a\sim\, b\sim\, (a\sim\, x)^{b\sim - 1}}{\left(1 + (a\sim\, x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$
$$\text{"f(x)"}, \frac{a\sim^{b\sim}\, b\sim\, \mathrm{e}^{b\sim\, x}}{\left(1 + a\sim^{b\sim}\, \mathrm{e}^{b\sim\, x}\right)^2}$$

"i is", 7,
" --
----------"

$$g := t \to \mathrm{e}^{-t}$$
$$l := 0$$
$$u := \infty$$
$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim\, (-\ln(y\sim))^{b\sim - 1}}{\left(1 + a\sim^{b\sim}\, (-\ln(y\sim))^{b\sim}\right)^2\, y\sim}\right], [0, 1], [\text{"Continuous"}, \text{"PDF"}]\right]$$
$$\text{"l and u"}, 0, \infty$$
$$\text{"g(x)"}, \mathrm{e}^{-x}, \text{"base"}, \frac{a\sim\, b\sim\, (a\sim\, x)^{b\sim - 1}}{\left(1 + (a\sim\, x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$
$$\text{"f(x)"}, \frac{a\sim^{b\sim}\, b\sim\, (-\ln(x))^{b\sim - 1}}{\left(1 + a\sim^{b\sim}\, (-\ln(x))^{b\sim}\right)^2\, x}$$

"i is", 8,
" --
----------"

$$g := t \to -\ln(t)$$
$$l := 0$$
$$u := \infty$$
$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim\, \mathrm{e}^{-b\sim\, y\sim}}{\left(1 + a\sim^{b\sim}\, \mathrm{e}^{-b\sim\, y\sim}\right)^2}\right], [-\infty, \infty], [\text{"Continuous"}, \text{"PDF"}]\right]$$
$$\text{"l and u"}, 0, \infty$$
$$\text{"g(x)"}, -\ln(x), \text{"base"}, \frac{a\sim\, b\sim\, (a\sim\, x)^{b\sim - 1}}{\left(1 + (a\sim\, x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

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

"i is", 9,

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

$$g := t \rightarrow \ln(t+1)$$
$$l := 0$$
$$u := \infty$$
$$Temp := \left[\left[y\sim \rightarrow \frac{a\sim^{b\sim}\, b\sim\, \left(e^{y\sim}-1\right)^{b\sim-1}\, e^{y\sim}}{\left(1+a\sim^{b\sim}\left(e^{y\sim}-1\right)^{b\sim}\right)^2}\right], [0, \infty], ["Continuous", "PDF"]\right]$$
$$"l\ and\ u",\ 0,\ \infty$$
$$"g(x)",\ \ln(x+1),\ "base",\ \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2},\ "LogLogisticRV(a,b)"$$
$$"f(x)",\ \frac{a\sim^{b\sim}\, b\sim\, \left(e^{x}-1\right)^{b\sim-1}\, e^{x}}{\left(1+a\sim^{b\sim}\left(e^{x}-1\right)^{b\sim}\right)^2}$$

"i is", 10,

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

$$g := t \rightarrow \frac{1}{\ln(t+2)}$$
$$l := 0$$
$$u := \infty$$
$$Temp := \left[\left[y\sim \rightarrow \frac{a\sim^{b\sim}\, b\sim\, \left(e^{\frac{1}{y\sim}}-2\right)^{b\sim-1}\, e^{\frac{1}{y\sim}}}{\left(1+a\sim^{b\sim}\left(e^{\frac{1}{y\sim}}-2\right)^{b\sim}\right)^2 y\sim^2}\right], \left[0, \frac{1}{\ln(2)}\right], ["Continuous", "PDF"]\right]$$
$$"l\ and\ u",\ 0,\ \infty$$
$$"g(x)",\ \frac{1}{\ln(x+2)},\ "base",\ \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2},\ "LogLogisticRV(a,b)"$$
$$"f(x)",\ \frac{a\sim^{b\sim}\, b\sim\, \left(e^{\frac{1}{x}}-2\right)^{b\sim-1}\, e^{\frac{1}{x}}}{\left(1+a\sim^{b\sim}\left(e^{\frac{1}{x}}-2\right)^{b\sim}\right)^2 x^2}$$

"i is", 11,

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

$$g := t \rightarrow \tanh(t)$$
$$l := 0$$
$$u := \infty$$

$$Temp := \left[\left[y\sim \to -\frac{a\sim^{b\sim}\, b\sim \operatorname{arctanh}(y\sim)^{b\sim-1}}{\left(1+a\sim^{b\sim}\operatorname{arctanh}(y\sim)^{b\sim}\right)^2 \left(y\sim^2-1\right)}\right], [0, 1], [\text{"Continuous"}, \text{"PDF"}]\right]$$

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

$$\text{"g(x)"}, \tanh(x), \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

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

"i is", 12,
" ---
----------"

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

$$l := 0$$

$$u := \infty$$

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

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

$$\text{"g(x)"}, \sinh(x), \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

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

"i is", 13,
" ---
----------"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim \sinh(y\sim)^{b\sim-1}\cosh(y\sim)}{\left(1+a\sim^{b\sim}\sinh(y\sim)^{b\sim}\right)^2}\right], [0, \infty], [\text{"Continuous"}, \text{"PDF"}]\right]$$

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

$$\text{"g(x)"}, \operatorname{arcsinh}(x), \text{"base"}, \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, \text{"LogLogisticRV(a,b)"}$$

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

"i is", 14,
" ---
----------"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim\, (-1+\operatorname{arccsch}(y\sim))^{b\sim-1}}{\sqrt{y\sim^2+1}\,\left(1+a\sim^{b\sim}\,(-1+\operatorname{arccsch}(y\sim))^{b\sim}\right)^2 |y\sim|}\right], \left[0, \frac{2}{\mathrm{e}-\mathrm{e}^{-1}}\right],\right.$$

$$\left.["\text{Continuous}", "\text{PDF}"]\right]$$

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

$$"\text{g(x)}", \operatorname{csch}(x+1), "\text{base}", \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, "\text{LogLogisticRV(a,b)}"$$

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

"i is", 15,

" --"

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \to -\frac{a\sim^{b\sim}\, b\sim \left(-\frac{\sinh(y\sim)-1}{\sinh(y\sim)}\right)^{b\sim} \cosh(y\sim)}{(\sinh(y\sim)-1)\sinh(y\sim)\left(1+a\sim^{b\sim}\left(-\frac{\sinh(y\sim)-1}{\sinh(y\sim)}\right)^{b\sim}\right)^2}\right], \left[0, \ln\left(1\right.\right.\right.$$

$$\left.\left.\left.+\sqrt{2}\right)\right], ["\text{Continuous}", "\text{PDF}"]\right]$$

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

$$"\text{g(x)}", \operatorname{arccsch}(x+1), "\text{base}", \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, "\text{LogLogisticRV(a,b)}"$$

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

"i is", 16,

" --"

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

$$l := 0$$

$$u := \infty$$

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

$$\left.["Continuous", "PDF"]\right]$$

$$"l and u", 0, \infty$$

$$"g(x)", \frac{1}{\tanh(x+1)}, "base", \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^{2}}, "LogLogisticRV(a,b)"$$

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

"i is", 17,

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

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

$$l := 0$$

$$u := \infty$$

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

$$\left.["Continuous", "PDF"]\right]$$

$$"l and u", 0, \infty$$

$$"g(x)", \frac{1}{\sinh(x+1)}, "base", \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^{2}}, "LogLogisticRV(a,b)"$$

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

"i is", 18,

" ---

----------"

$$g := t \to \frac{1}{\operatorname{arcsinh}(t+1)}$$

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim \left(-1 + \sinh\left(\frac{1}{y\sim}\right)\right)^{b\sim - 1} \cosh\left(\frac{1}{y\sim}\right)}{\left(1 + a\sim^{b\sim} \left(-1 + \sinh\left(\frac{1}{y\sim}\right)\right)^{b\sim}\right)^2 y\sim^2}\right], \left[0, \frac{1}{\ln\left(1+\sqrt{2}\right)}\right], \right.$$

$$\left. ["\text{Continuous}", "\text{PDF}"]\right]$$

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

$$"\text{g(x)}", \frac{1}{\operatorname{arcsinh}(x+1)}, "\text{base}", \frac{a\sim b\sim (a\sim x)^{b\sim - 1}}{\left(1 + (a\sim x)^{b\sim}\right)^2}, "\text{LogLogisticRV(a,b)}"$$

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

"i is", 19,

" --

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

$$l := 0$$

$$u := \infty$$

$$Temp := \left[\left[y\sim \to \frac{a\sim^{b\sim}\, b\sim \operatorname{arccsch}\left(\frac{1}{y\sim - 1}\right)^{b\sim - 1}}{\sqrt{y\sim^2 - 2\,y\sim + 2}\, \left(1 + a\sim^{b\sim} \operatorname{arccsch}\left(\frac{1}{y\sim - 1}\right)^{b\sim}\right)^2}\right], [1, \infty], \right.$$

$$\left. ["\text{Continuous}", "\text{PDF}"]\right]$$

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

$$"\text{g(x)}", \frac{1}{\operatorname{csch}(x)} + 1, "\text{base}", \frac{a\sim b\sim (a\sim x)^{b\sim - 1}}{\left(1 + (a\sim x)^{b\sim}\right)^2}, "\text{LogLogisticRV(a,b)}"$$

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

"i is", 20,
" --"

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

$$l := 0$$

$$u := \infty$$

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

$$"l and u", 0, \infty$$

$$"g(x)", \tanh\left(\frac{1}{x}\right), "base", \frac{a\sim b\sim (a\sim x)^{b\sim-1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, "LogLogisticRV(a,b)"$$

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

"i is", 21,
" --"

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

$$l := 0$$

$$u := \infty$$

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

$$"l and u", 0, \infty$$

$$"g(x)", \operatorname{csch}\left(\frac{1}{x}\right), "base", \frac{a\sim b\sim (a\sim x)^{b\sim -1}}{\left(1+(a\sim x)^{b\sim}\right)^2}, "LogLogisticRV(a,b)"$$

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

"i is", 22,

" --"

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

$$l := 0$$

$$u := \infty$$

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

$$"l and u", 0, \infty$$

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

$$"f(x)", \frac{a\sim^{b\sim} b\sim \sinh(x)^{b\sim -1} \cosh(x)}{\left(1+a\sim^{b\sim} \sinh(x)^{b\sim}\right)^2} \tag{3}$$