Another illustration of the Use of Discrete Distributions Using Dynamics UI features

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```
Get["BarCharts`"];

imageWidth = 500;
imageWidth2 = 1 * imageWidth / 2;

imageWidthPars1 = 0.55 * imageWidth;
sliderImage = {0.40 * imageWidthPars1, 20};

imageWidthPars2 = .97 * (imageWidth - imageWidthPars1);
imageH1 = 110;
imageH1in = imageH1 * .65;

imageH3 = 60;
imageH2 = 200;

cdft := Style["cumulative distribution function", Small]
pmft := Style["probability mass function", Small]
sc := Style["Scale y-axis for PMF to be 1 always", Small]
b3 := Labeled[Checkbox[Dynamic[scale]], sc, {Right}]

scaleXq := Style["Zoom in", Small]
scaleXql := Labeled[Checkbox[Dynamic[scaleX]], scaleXq, {Right}]

b3Panel := Panel[Column[{b3, scaleXql}] , ImageSize → {imageWidthPars2, imageH1in}]

(*-----------------------------------------------------*)
(*make plots*)
(*-----------------------------------------------------*)
makePlots[distribution_, pdfLimits_, cdfLimits_, pdfAxesOrigion_,
  cdfAxesOrigin_, ticksForPdf_, ticksForCDF_] := Module[{k, tbl},
  (*tbl=Table[{k,PDF[distribution,k],1},{k,pdfLimits[[1]],pdfLimits[[2]]}];*)

  pdf = GeneralizedBarChart[
    Table[{k, PDF[distribution, k], 1}, {k, pdfLimits[[1]], pdfLimits[[2]]}],
    BarStyle → {GrayLevel[0.8]}, AxesOrigin → pdfAxesOrigion, AxesLabel → {"x", ""},
    PlotRange → {Automatic, If[scale, {0, 1}, All]}, PlotLabel → pmft,
    Ticks → ticksForPdf, ImagePadding → 30, TicksStyle → Small];

  cdf = Plot[CDF[distribution, k], {k, cdfLimits[[1]], cdfLimits[[2]]},
```

```
    AxesOrigin → cdfAxesOrigin, PlotLabel → cdft, AxesLabel → {"x", ""},
    Ticks → ticksForCDF, ImagePadding → 30, TicksStyle → Small]
 ]
(*-----------------------------------------------------------*)
(*displays final plot*)
(*-----------------------------------------------------------*)
set[pdf_, cdf_, label_] :=
 Module[{}, Labeled[Grid[{{pdf, cdf}}, Alignment → {{Left, Left}}],
   (Style[#1, FontSize → 10] &) /@ label, {{Bottom, Center}}]]

(*-----------------------------------------------------------*)
(*finds mean and var of dist*)
(*-----------------------------------------------------------*)
getMeanVar[p_] := Module[{mean, var}, mean = N[Mean[p], 16];
  mean = NumberForm[mean, {9, 7}, NumberPadding → {" ", "0"}];
  var = N[Variance[p], 16];
  var = NumberForm[var, {9, 7}, NumberPadding → {" ", "0"}];
  {mean, var}]

(*-----------------------------------------------------------*)
(*        hack to find CDF limit for plotting           *)
(*-----------------------------------------------------------*)
getLimit[y_, var_] := Module[{to = 5}, While[(1 - y /. var → to) > 0.001, to = to + 10];  to]

(*-----------------------------------------------------------*)
(*            hack to find ticks                         *)
(*-----------------------------------------------------------*)
getTicks[from_, to_] := Module[{}, If[to - from > 10,
   {Range[from, to, Round[(to - from) / 10]], Automatic}, {Range[from, to, 1], Automatic}]]

(*-----------------------------------------------------------*)
(*              binomial                                  *)
(*-----------------------------------------------------------*)
bs1 := Slider[Dynamic[n], {1, 100, 1}, ImageSize → Tiny]
lbs1 := Labeled[bs1, Style["N, Number of trials", Small], Left]
llbs1 := {lbs1, Style[Dynamic[n], Small]}
bs2 := Slider[Dynamic[p], {0, 1, 0.05}, ImageSize → Tiny]
lbs2 := Labeled[bs2, Style["p, probability of success in each trial", Small], Left]
llbs2 := {lbs2, Style[Dynamic[p], Small]}
parsBinomialMain := Labeled[
  Panel[ Column[{Row[llbs1], Row[llbs2]}], ImageSize → {imageWidthPars1, imageH1in}],
  Style["Select Distribution Parameters", Small], {{Top, Left}}]
parsBinomial := Row[ {parsBinomialMain , b3Panel}]

binomial[] := Module[{mean, var, from, to, data, dist, x},
  dist = BinomialDistribution[n, p];
  {mean, var} = getMeanVar[dist];
  If[scaleX, to = getLimit[CDF[dist, x], x], to = 110];
  from = 0;
  makePlots[dist, {from, to}, {-2, to}, {-0.5, 0}, {-1, 0}, Automatic, getTicks[-2, to]];
  label =
   "X: Number of successes in n independent trials. Trial has p chance of success";
  data = StringJoin["\nMean: np=", ToString[mean],
    "\tVariance: n(1-p)p", ToString[var]];
```

```
  label = Text[Style[StringJoin[label, data]]];
  Column[
   {
    parsBinomial, Row[{Panel[Dynamic[pdf], ImageSize → {imageWidth2, imageH2}],
      Panel[Dynamic[cdf], ImageSize → {imageWidth2, imageH2}]}
    ],
    Panel[Dynamic[label], ImageSize -> {imageWidth, imageH3}]
   }
  ]
 ]

(*-------------------------------------------------------*)
(*poisson*)
(*-------------------------------------------------------*)
maxLambda = 30;
sp1 := Slider[Dynamic[λ], {0.1, maxLambda, 0.1}, ImageSize → Tiny]
lsp1 := Labeled[sp1, Style["λ, Mean rate of arrival", Small], Left]
llsp1 := {lsp1, Style[Dynamic[λ], Small]}

parsPoissonMain :=
 Labeled[Panel[ Column[{Row[llsp1]}], ImageSize → {imageWidthPars1, imageH1in}],
  Style["Select Distribution Parameters", Small], {{Top, Left}}]
parsPoisson := Row[ {parsPoissonMain , b3Panel}]

poisson[] := Module[{x, mean, var, from, data, to, dist},
  dist = PoissonDistribution[λ];
  {mean, var} = getMeanVar[dist];
  from = 0;
  If[scaleX, to = getLimit[CDF[dist, x], x], to = 50];
  makePlots[dist, {from, to}, {-2, to}, {-0.5, 0}, {-1, 0}, Automatic, getTicks[-2, to]];
  label = "X: Number of arrivals when average rate of arrival is λ";
  data = StringJoin["\nMean: λ=", ToString[mean], "\tVariance: λ=", ToString[var]];
  label = Text[Style[StringJoin[label, data]]];
  Column[
   {
    parsPoisson,
    Row[{Panel[Dynamic[pdf], ImageSize → {imageWidth2, imageH2}, ImageMargins → 0],
      Panel[Dynamic[cdf], ImageSize → {imageWidth2, imageH2}, ImageMargins → 0]}
    ],
    Panel[Dynamic[label], ImageSize -> {imageWidth, imageH3}]
   }
  ]
 ]

(*-------------------------------------------------------*)
(*Main menu*)
(*-------------------------------------------------------*)
Panel[
 Grid[{{ Labeled[ PopupMenu[Dynamic[proc], {binomial → "Binomial", poisson → "Poisson"}
     ], Style["Select Distribution"], Left]
   }, {Dynamic[proc[]]}}]
]
```

Out[39]=

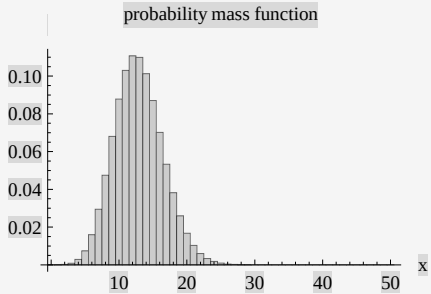
Select Distribution Poisson

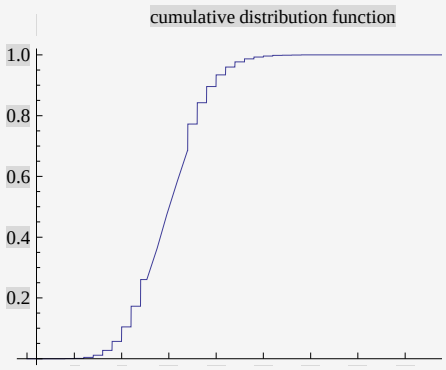
Select Distribution Parameters

λ, Mean rate of arrival 12.9

Scale y−axis for PMF to be 1 always

Zoom in





X: Number of arrivals when average rate of arrival is λ

Mean: λ= 12.9000000 Variance: λ= 12.9000000