Generating Random Variable: Verification by *Mathematica*

In[1]:=
```
<<Statistics`DataManipulation`
```

Random variables generated by C

In[37]:=
```
SetDirectory["/Users/takasu/home/情報科学科の仕事/講義/平成２０年度/H20 大学院講義/
    Generating random numbers/random variables/build/Development/"]
```

Out[37]=
```
/Users/takasu/home/情報科学科の仕事/講義/平成２０年度/H20 大学院講義/
  Generating random numbers/random variables/build/Development
```

Uniform distribution generated by C

In[23]:=
```
data = ReadList["uniform.out",Real];
len = Length[data]
maxdata = Max[data]
```

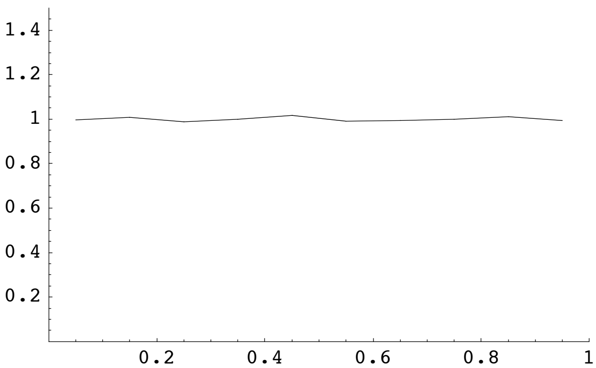
Out[24]= 100000

Out[25]= 0.999993

In[26]:=
```
dx = 0.1;
categories = 1/dx;
counts = BinCounts[ data,{0,maxdata,dx}]
midpoints = Table[x-dx/2,{x,dx,maxdata+dx,dx}];

dist2 = Transpose[ {midpoints, counts/len*categories}];
```

Out[28]= {9964, 10094, 9890, 9981, 10172, 9911, 9947, 9989, 10110, 9942}

In[31]:=
```
g = ListPlot[ dist2,PlotJoined->True, PlotRange->{{0,1},{0,1.5}}]
```



Out[31]= - Graphics -

In[32]:= **meanUniform = Apply[Plus, data]/len**

Out[32]= 0.500057

In[33]:= **varianceUniform = Apply[Plus, (data - meanUniform)^2]/len**

Out[33]= 0.0833015

In[34]:= **meanUniform = Integrate[x ,{x,0,1}]**

Out[34]= $\frac{1}{2}$

In[35]:= **Integrate[(x-meanUniform)^2,{x,0,1}]**

Out[35]= $\frac{1}{12}$

In[36]:= **N[%]**

Out[36]= 0.0833333

Exponential distribution generated by C

In[38]:=
```
data = ReadList["exp.out",Real];
maxdata = Max[data]
len = Length[data]
```

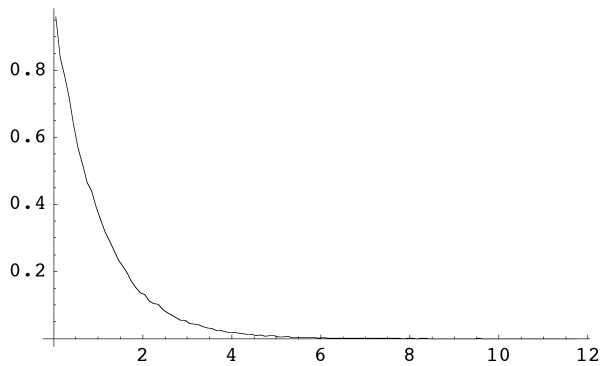
Out[39]= 11.7769

Out[40]= 100000

In[41]:=
```
dx = 0.1;
categories = 1/dx;
counts = BinCounts[ data,{0,maxdata,dx}]
midpoints = Table[x-dx/2,{x,dx,maxdata+dx,dx}];

dist2 = Transpose[ {midpoints, counts/len*categories}];
```

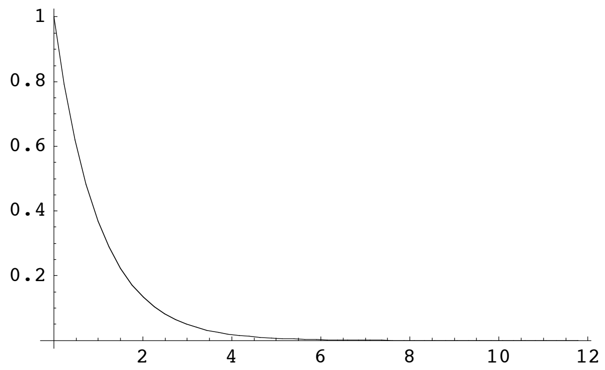
Out[43]= {9601, 8372, 7824, 7170, 6359, 5666, 5185, 4654, 4401, 3926, 3538, 3181, 2920, 2626, 2346, 2157, 1946, 1706, 1514, 1372, 1305, 1126, 1040, 1022, 867, 769, 698, 628, 549, 543, 446, 421, 420, 349, 322, 305, 250, 237, 212, 184, 189, 162, 143, 125, 116, 99, 102, 79, 99, 84, 59, 54, 62, 34, 37, 39, 29, 26, 32, 21, 23, 22, 18, 13, 17, 18, 13, 18, 12, 12, 9, 8, 6, 6, 7, 6, 3, 4, 2, 5, 4, 2, 3, 4, 1, 0, 1, 2, 0, 1, 1, 0, 0, 1, 0, 3, 0, 1, 1, 0, 2, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1}

In[46]:= **g = ListPlot[dist2,PlotJoined->True, PlotRange->All]**

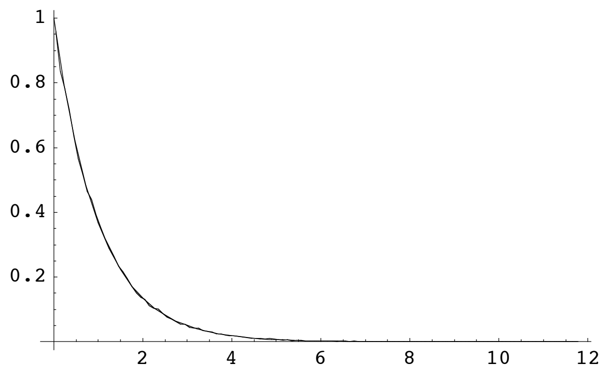


Out[46]= - Graphics -

```
In[47]:= g2 = Plot[ Exp[-lambda x]lambda/.lambda->1,{x,0,maxdata},
              PlotRange->All]
```



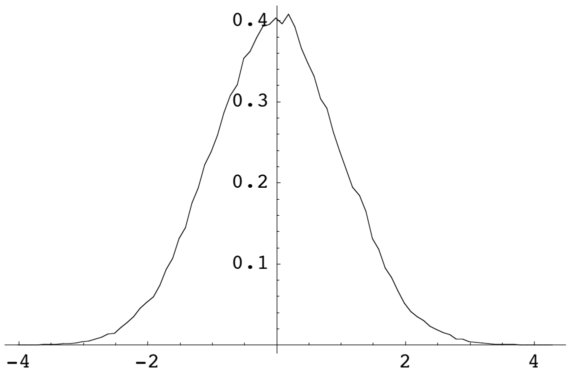

```
Out[47]=  - Graphics -

In[48]:= Show[g,g2]
```




```
Out[48]=  - Graphics -

In[49]:=
         meanLog = Apply[ Plus, data]/len

Out[49]=  1.00031

In[50]:= varianceLog = Apply[Plus, (data - meanLog)^2]/len

Out[50]=  0.997281

In[53]:= mean = Integrate[ x lambda Exp[-lambda x],{x,0,Infinity}]/.lambda->1

Out[53]=  1

In[52]:= Integrate[ (x-mean)^2 lambda Exp[-lambda x],{x,0,Infinity}]/.lambda->1

Out[52]=  1
```

Gaussian distribution generated by C

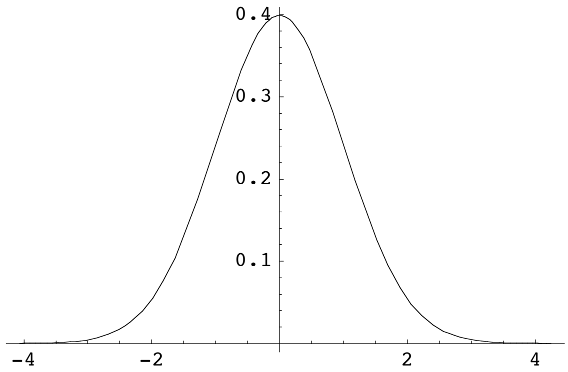
```
In[54]:= data = ReadList["gauss.out",Real];
         maxdata = Max[data]
         mindata = Min[data]
         len = Length[data]

Out[55]= 4.24326

Out[56]= -4.06699

Out[57]= 100000

In[58]:= dx = 0.1;
         categories = 1/dx;
         counts = BinCounts[ data,{mindata,maxdata,dx}]
         midpoints = Table[x-dx/2,{x,mindata+dx,maxdata+dx,dx}];

         dist2 = Transpose[ {midpoints, counts/len*categories}];

Out[60]= {2, 2, 4, 6, 7, 9, 7, 18, 16, 31, 42, 53, 70, 99, 134, 143, 218, 279, 352, 450, 524,
          592, 737, 937, 1070, 1318, 1452, 1746, 1935, 2224, 2385, 2589, 2866, 3076, 3211,
          3534, 3625, 3786, 3931, 3952, 4033, 3961, 4080, 3924, 3664, 3477, 3314, 3039,
          2918, 2627, 2387, 2168, 1947, 1846, 1645, 1314, 1181, 950, 829, 664, 517, 415,
          350, 306, 233, 192, 150, 125, 76, 73, 41, 35, 25, 15, 14, 7, 8, 8, 1, 6, 0, 1, 0, 1}

In[63]:= g = ListPlot[ dist2, PlotJoined->True, PlotRange->All]
```




```
Out[63]= - Graphics -

In[64]:= mean=.

In[65]:= gauss = 1/Sqrt[2Pi]/sd Exp[-(x-mean)^2/2/sd^2]/.{mean->0, sd->1}
```

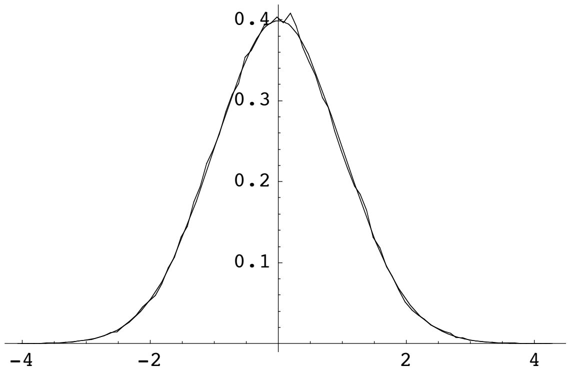
Out[65]= $\frac{e^{-\frac{x^2}{2}}}{\sqrt{2\pi}}$

In[66]:= **g2 = Plot[gauss,{x,mindata,maxdata}]**



Out[66]= - Graphics -

In[67]:= **Show[g,g2]**



Out[67]= - Graphics -

In[68]:= **meanGauss = Apply[Plus, data]/len**

Out[68]= -0.00308391

In[69]:= **varianceGauss = Apply[Plus, (data - meanGauss)^2]/len**

Out[69]= 0.998848

In[70]:= **meanGauss = Integrate[x gauss, {x,-Infinity, Infinity}]**

Out[70]= 0

In[71]:= **Integrate[(x-meanGauss)^2 gauss, {x,-Infinity, Infinity}]**

Out[71]= 1