demo_conti-var

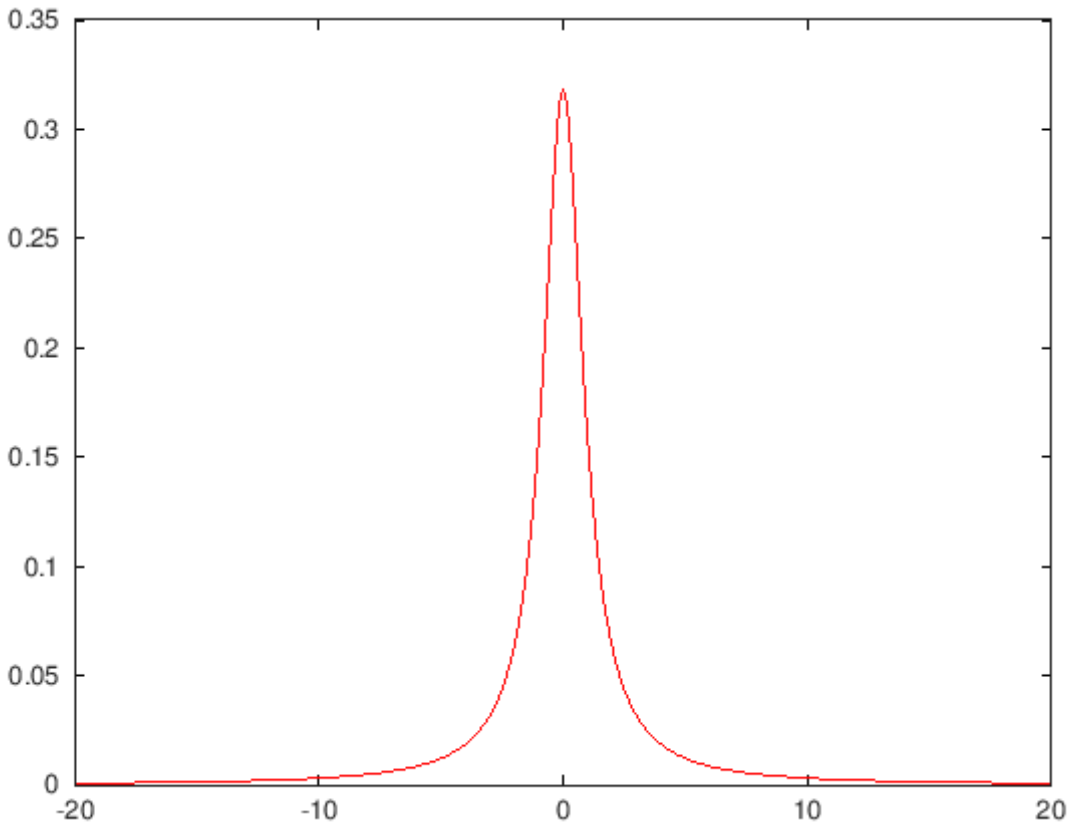
October 18, 2023

1

[6]:
```
N = 500000;
bins = 50;
```

1.1 1. Cauthy

[9]:
```
t = -20:0.1:20;
y = 1./(pi * (1 + t.^2));
plot(t, y, 'r');
```



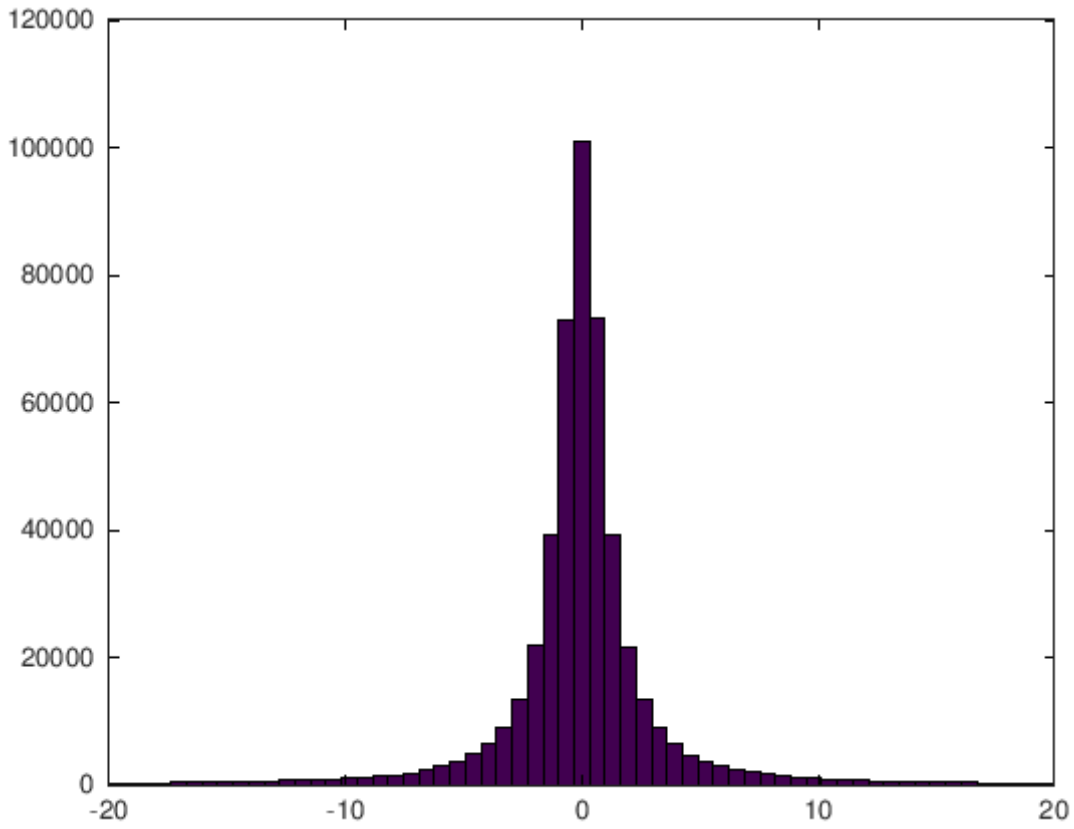
[ ]:
```
pkg load statistics;
U = unifrnd(0, 1, 1, N);
```

[7]:
```
tmp = tan(pi * (U - 0.5));
X = tmp((tmp > -20) & (tmp < 20));
```

[23]:
```
n_sample = length(X); %some samples may not stay inside the area.
bins = 61;
scale = n_sample * 40 / bins;
```

[24]:
```
hist(X, bins); hold on; plot(t, scale * y, 'g'); hold off;
```

```
error: __plt2vv__: vector lengths must match
error: called from
    __plt__>__plt2vv__ at line 487 column 5
    __plt__>__plt2__ at line 247 column 14
    __plt__ at line 112 column 18
    plot at line 229 column 10
```



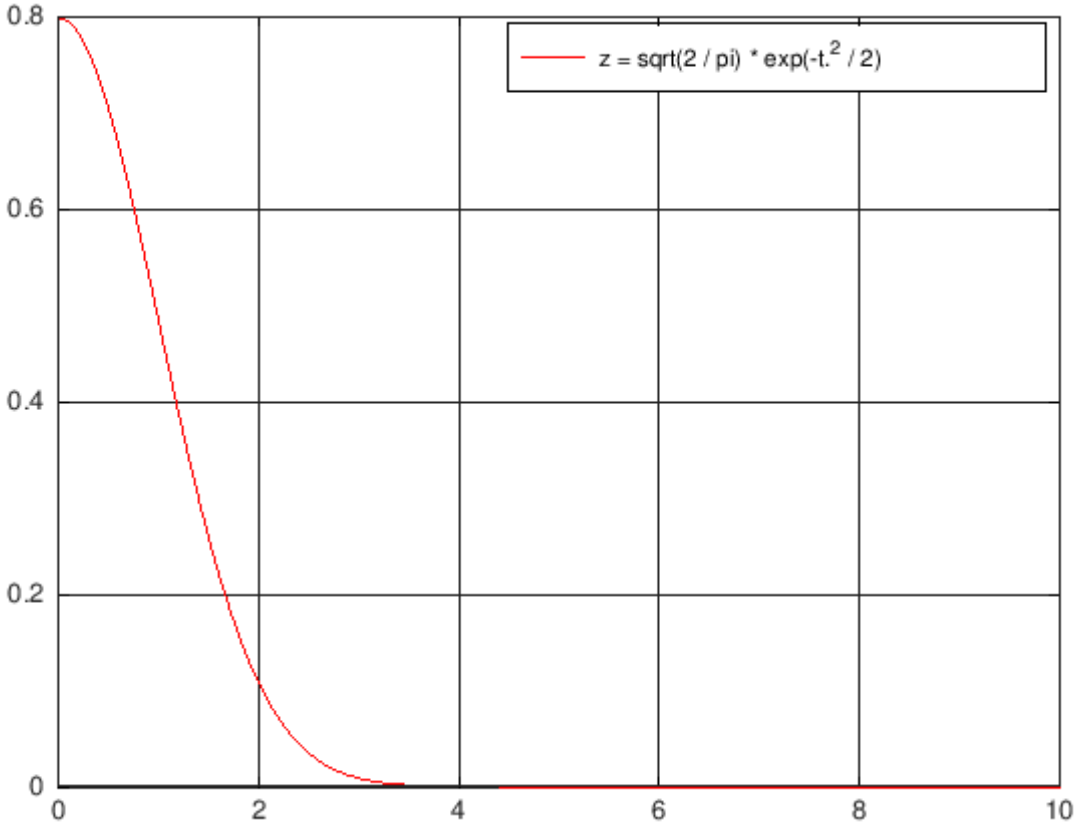
[ ]:
```

```

[ ]:

1.2 2.half normal distribution

$$z = \sqrt{\frac{2}{\pi}} e^{-\frac{t^2}{2}}$$

[25]:
```
t = 0:0.04:10;
z = sqrt(2 / pi) * exp(-t.^2 / 2);
plot(t, z, 'r'); legend('z = sqrt(2 / pi) * exp(-t.^2 / 2)'); grid on
```

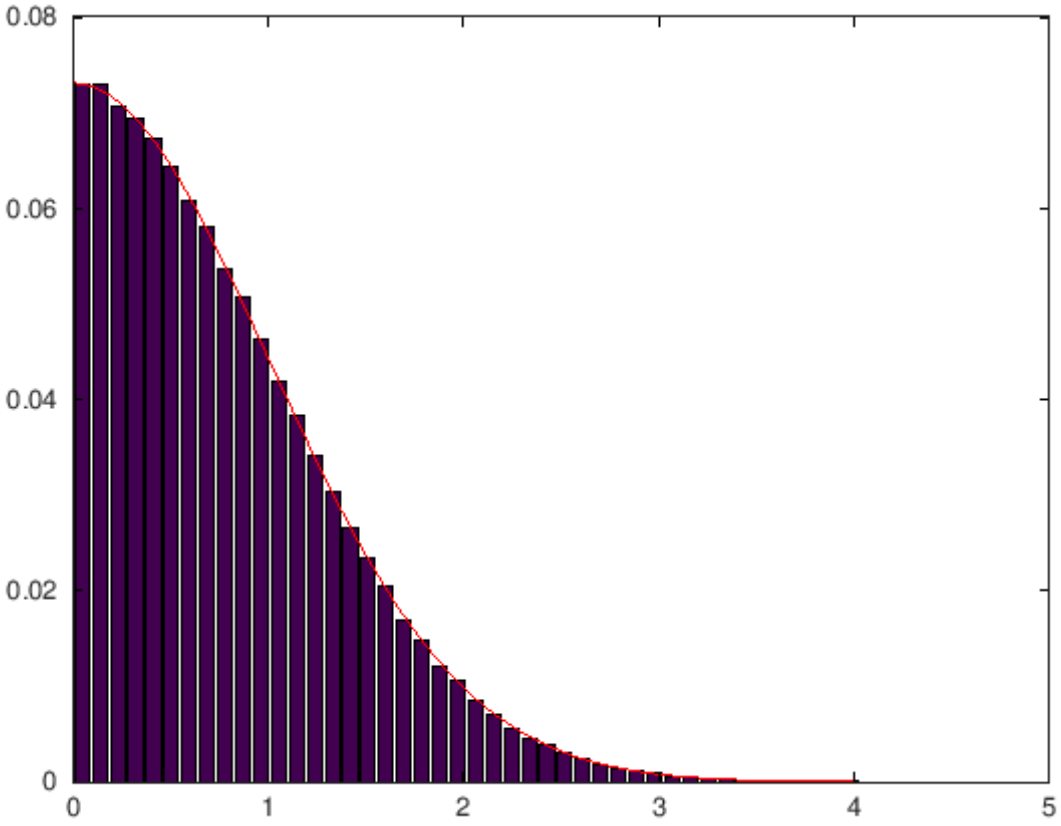


[26]:
```
Y = -log(unifrnd(0, 1, 1, N));
hY = exp(-(Y - 1).^2 / 2);    % this is the usually case, the latter one
                              % here contains g(x) is quite abnormal.
```

[27]:
```
U = unifrnd(0, 1, 1, N);
X = Y(U < hY & Y < 10);       % it's a infinte distribution.
```

[28]:
```
sample = length(X);
bins = 50; [Xnumber, Xcenters] = hist(X, bins);
```

[29]:
```
bar(Xcenters, Xnumber / sample);

scale = max(X)/ bins;          % caution, Xmax is variable.
hold on; plot(t, scale * z, 'r'); hold off;
```



[ ]:
```

```

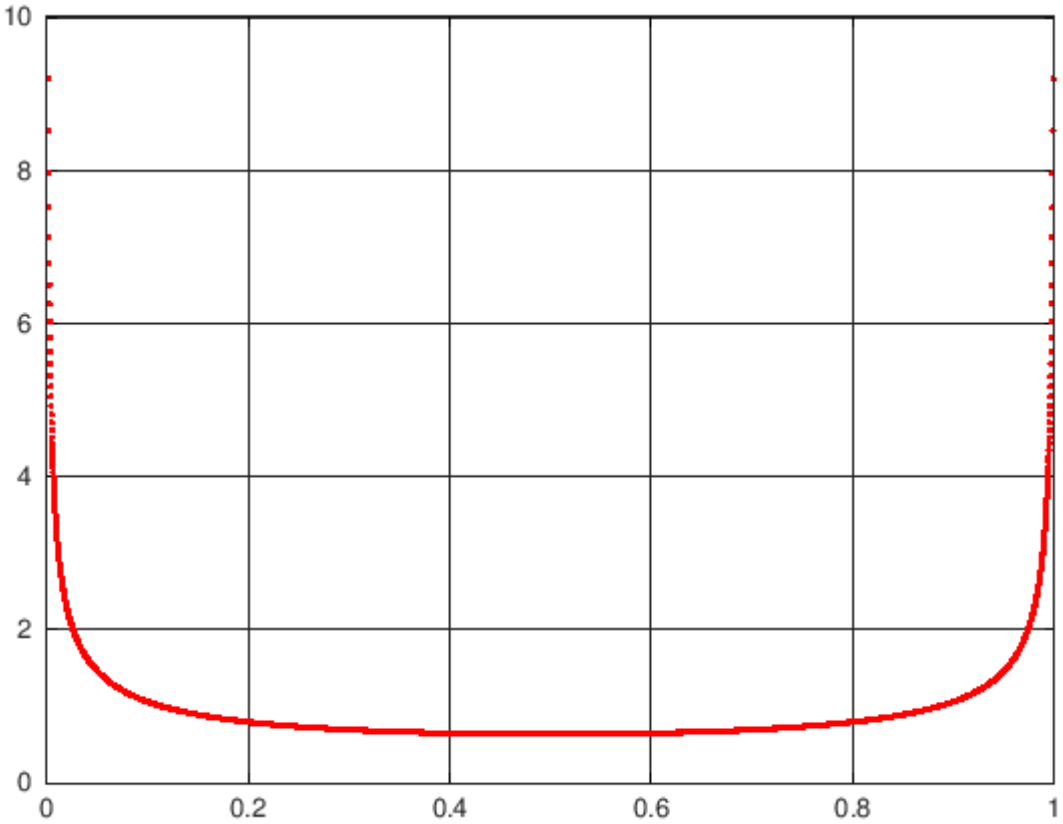
1.3 3. β-

[ ]:
```

```

[32]:
```
alpha = 0.5;
```

[60]:
```
dt = 0.0002;
t = dt : dt : 1 - dt;      % t is not equal to 0 | 1.
z = (t.^(alpha - 1).*((1 - t).^(alpha - 1))) / pi;
```

[61]:
```
plot(t, z, 'r.'); axis([0, 1, 0, 10]); grid on;
```



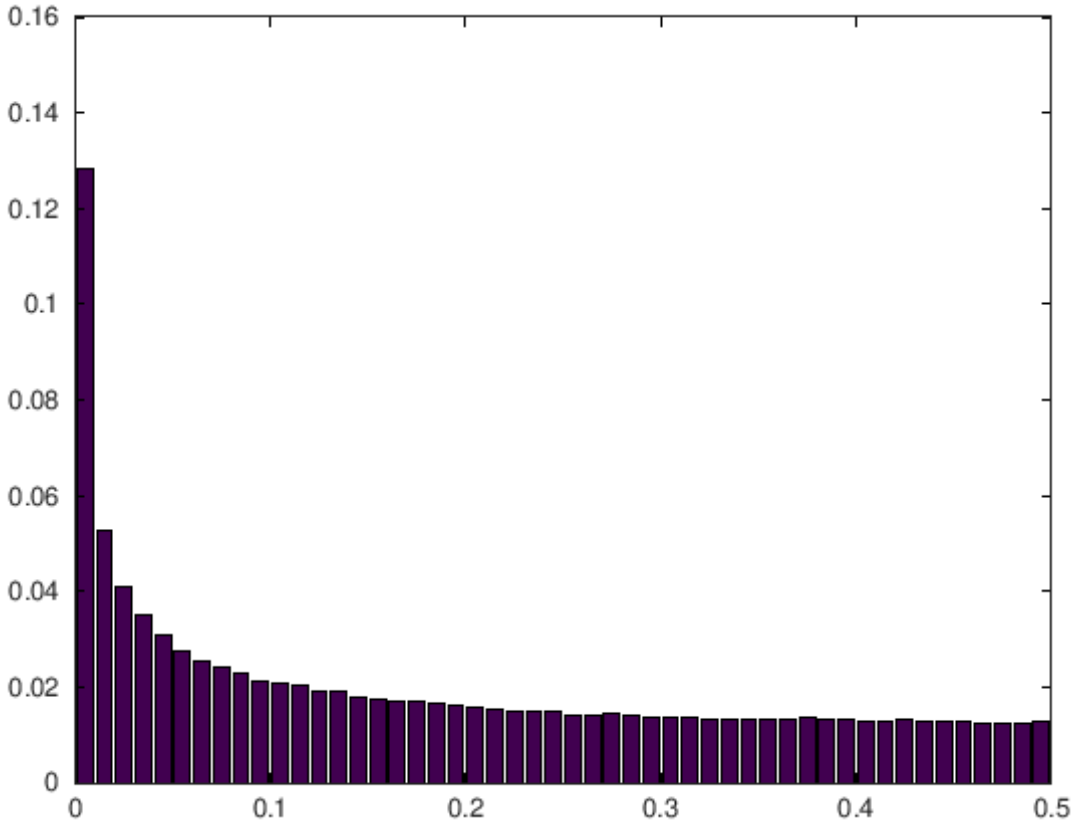
[ ]:

[62]:
```
V = unifrnd(0, 1, 1, N);
Y = 0.5 * V.^(1 / alpha);
h = (2 * (1 - Y)).^(alpha - 1);
```

[64]:
```
U = unifrnd(0, 1, 1, N);
X = Y(U < h);
```

[66]:
```
[Xnumber, Xcenters] = hist(X, bins);
```

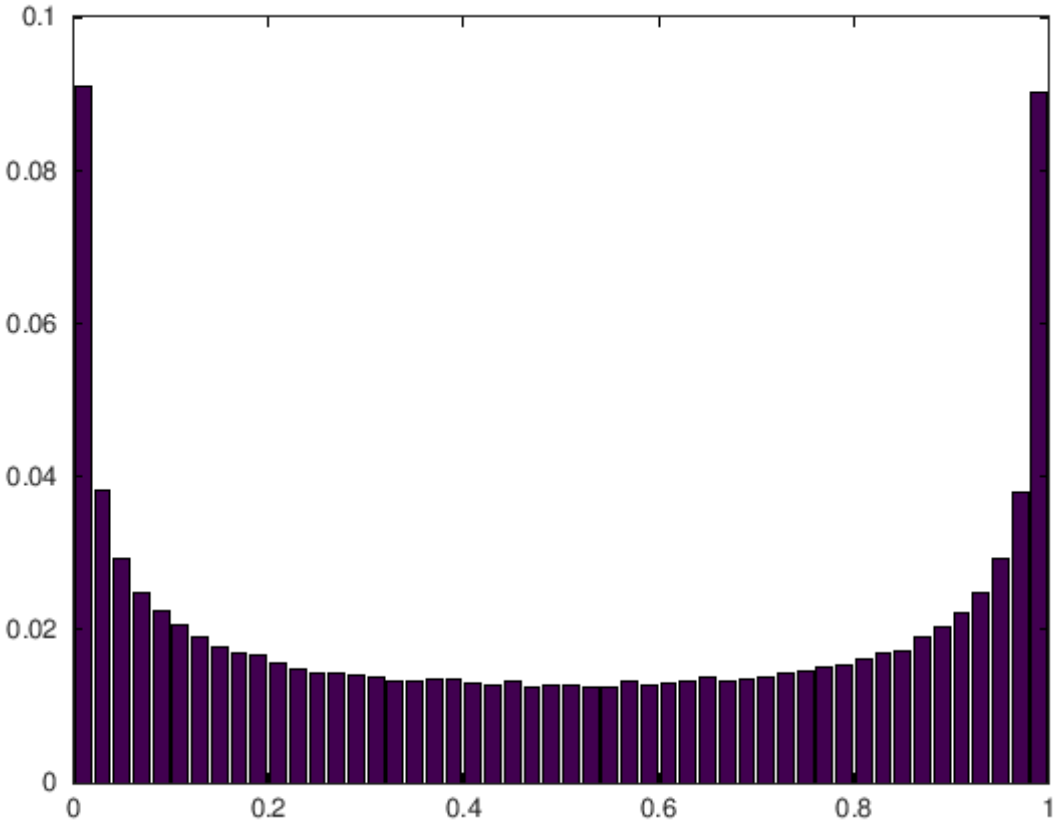
[67]:
```
bar(Xcenters, Xnumber / length(X));
```



[68]:
```
S = unifrnd(0, 1, 1, sample);
S = (S > 0.5);   % half probability for S = 1, others are 0.
X = (1 - S).*X + S.*(1 - X);  % half X become to (1 - X), S = 0|1.
```

[69]:
```
[Xnumber, Xcenters] = hist(X, bins);
```

[72]:
```
bar(Xcenters, Xnumber / length(X));
```


0.1
0.08
0.06
0.04
0.02
0
0
0.2
0.4
0.6
0.8
1

[ ]: