

Lecture 12

Continuous Distribution

2. Continuous Probability Distribution:

Example: Exponential Distribution with $\lambda = 0.6$

Write and draw the probability density function:

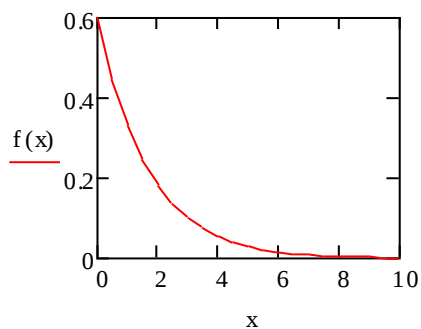
$$\lambda := 0.6$$

$$f(x) := \lambda \cdot e^{-\lambda \cdot x}$$

$$x := 0, 0.5, 10$$

$$f(x) =$$

0.6
0.444
0.329
0.244
0.181
0.134
0.099
0.073
0.054
0.04
0.03
0.022
0.016
0.012
$8.997 \cdot 10^{-3}$
...

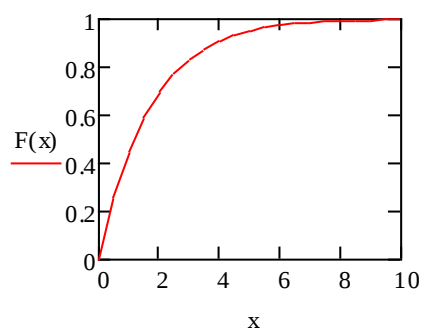


Write and draw the function of cumulative distribution

$$F(x) := \int_0^x f(x) dx \quad \text{OR} \quad F(x) := 1 - e^{-\lambda \cdot x}$$

F(x) =

0
0.259
0.451
0.593
0.699
0.777
0.835
0.878
0.909
0.933
0.95
0.963
0.973
0.98
0.985
...



Write and draw the function of reliability distribution

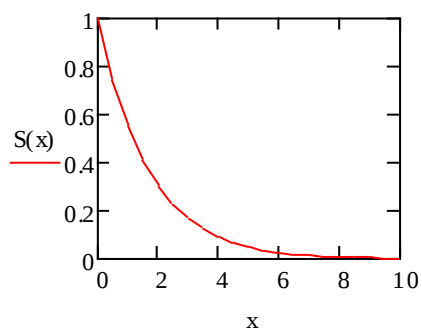
$$S(x) := 1 - F(x)$$

OR

$$S(x) := e^{-\lambda \cdot x}$$

S(x) =

1
0.741
0.549
0.407
0.301
0.223
0.165
0.122
0.091
0.067
0.05
0.037
0.027
0.02
0.015
...



Write and draw the function of hazard (failure rate) distribution

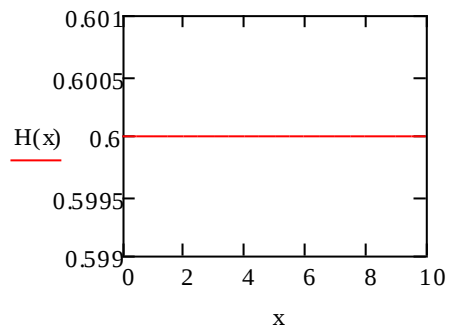
$$\underline{H(x)} := \frac{\lambda \cdot e^{-\lambda \cdot x}}{e^{-\lambda \cdot x}}$$

OR

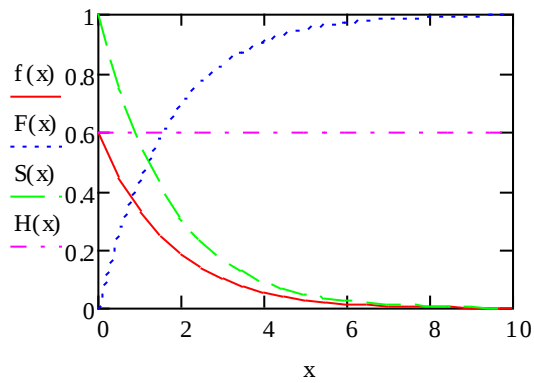
$$\underline{H(x)} := \frac{f(x)}{S(x)}$$

H(x) =

0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
0.6
...



x =	f (x) =	F(x) =	S(x) =	H(x) =
0	0.6	0	1	0.6
0.5	0.444	0.259	0.741	0.6
1	0.329	0.451	0.549	0.6
1.5	0.244	0.593	0.407	0.6
2	0.181	0.699	0.301	0.6
2.5	0.134	0.777	0.223	0.6
3	0.099	0.835	0.165	0.6
3.5	0.073	0.878	0.122	0.6
4	0.054	0.909	0.091	0.6
4.5	0.04	0.933	0.067	0.6
5	0.03	0.95	0.05	0.6
5.5	0.022	0.963	0.037	0.6
6	0.016	0.973	0.027	0.6
6.5	0.012	0.98	0.02	0.6
7	8.997·10 ⁻³	0.985	0.015	0.6
...	...	...	...	...



Using Build-in functions:

Generating a random sample from exponential distribution:

```
x := rexp(100, 1.2)
```

```
x := sort(x)
```

x =

	0
0	$2.675 \cdot 10^{-3}$
1	$9.632 \cdot 10^{-3}$
2	0.014
3	0.028
4	0.038
5	0.043
6	0.11
7	0.124
8	0.138
9	0.142
10	0.143
11	0.145
12	0.146
13	0.148
14	0.151
15	...

Calculate the probability density function of any value of variable:

dexp(0.025 1.2) = 1.165

y := dexp(x, 1.2)

	0
0	1.196
1	1.186
2	1.18
3	1.16
4	1.147
5	1.139
6	1.051
7	1.035
8	1.016
9	1.012
10	1.011
11	1.008
12	1.007
13	1.005
14	1.002
15	...

y =

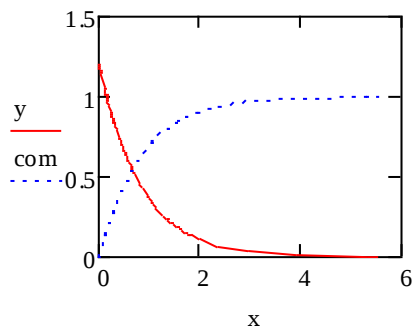
Calculate the cumulative function for any value of variable:

pexp(0.025 1.2) = 0.03

com := pexp(x, 1.2)

	0
0	$3.204 \cdot 10^{-3}$
1	0.011
2	0.017
3	0.033
4	0.044
5	0.051
6	0.124
7	0.138
8	0.153
9	0.157
10	0.158
11	0.16
12	0.161
13	0.162
14	0.165
15	...

com =



$$\text{relibil} := 1 - \text{com}$$

$$\text{relibil} =$$

	0
0	0.997
1	0.989
2	0.983
3	0.967
4	0.956
5	0.949
6	0.876
7	0.862
8	0.847
9	0.843
10	0.842
11	0.84
12	0.839
13	0.838
14	0.835
15	...

$$\text{haz} := \frac{y}{\text{relibil}}$$

$$\text{haz} =$$

	0
0	1.2
1	1.2
2	1.2
3	1.2
4	1.2
5	1.2
6	1.2
7	1.2
8	1.2
9	1.2
10	1.2
11	1.2
12	1.2
13	1.2
14	1.2
15	...

