CS215 Assignment-1

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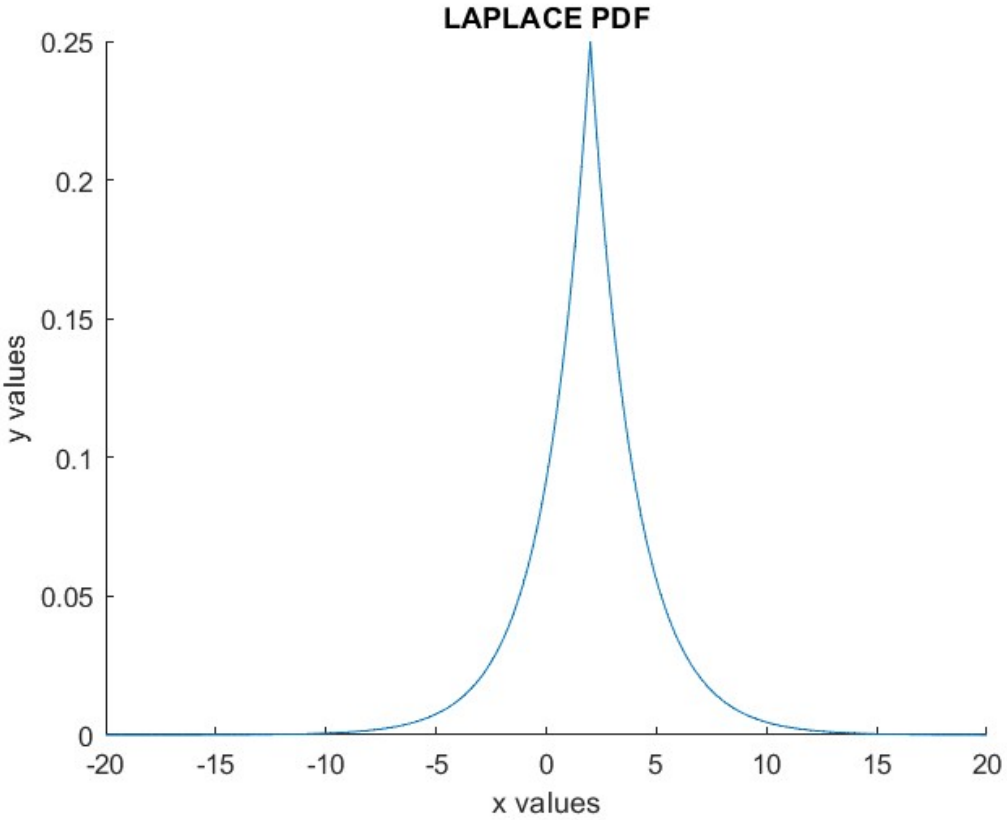
1 Laplace Distribution

$$f(x|\mu, b) = \frac{1}{2b} exp(-\frac{|x-\mu|}{b})$$

1.1 PDF

Laplace's Probability distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, scale parameter as b, wrote an array x from -20 to 20, with spacing of 0.1 between each number, wrote y as a function of x, and used plot(x,y) to plot the graph of Laplace PDF from -20 to +20, the peak should be at x=2 as it is the Location parameter, and its maximum value is 0.25 as shown in graph.



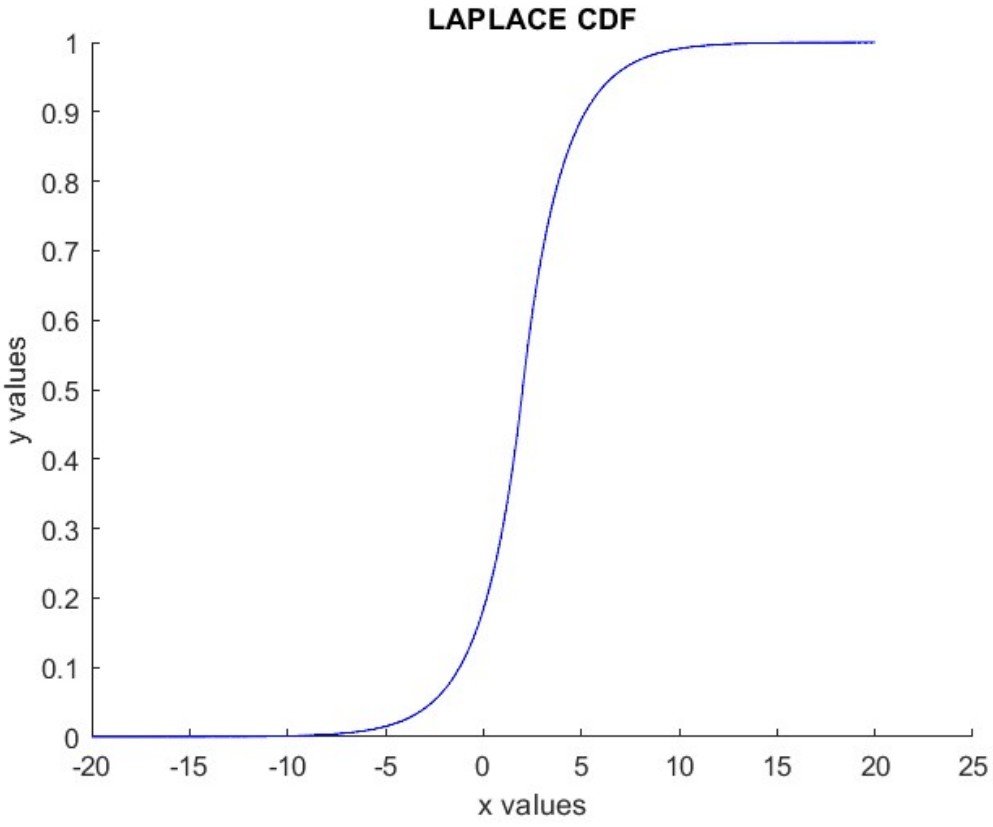
Instructions to run the code:
Run LAPLACEpdf.m file in codes, it gives the same graph as above

1.2 CDF

Laplace's Cumulative distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, Scale parameter as b, wrote a linear space xa from -20 to 20 with 4001 steps in between(0.01 gap), drawn the graph slice wise adding the previous values to $y(ab) \times 0.01$, using Riemann sum to find the CDF.

$$y(i+1) = y(i) + (yab(i) \times 0.01)$$



Instructions to run the code:
Run the LAPLACECDF.m in the codes, it gives the same graph as above

1.3 Variance

LAPLACE'S Distribution function's variance:

By taking Location parameter as u, Scale parameter as b, wrote a linear space x, from -40 to 40 with 8001 steps(0.01gap), found var by variance formula, using Riemann sum as given below.

$$var = var + ((x(i) - b)^2 \times y(i) \times 0.01)$$

The results are as below.
variance calculated =7.999995
variance theoretically = $2b^2 = 8$
Deviation from analytically known variance = 0.000005

Instructions to run the code:
Run the LAPLACEvar.m file in the code section it gives the same results as above.

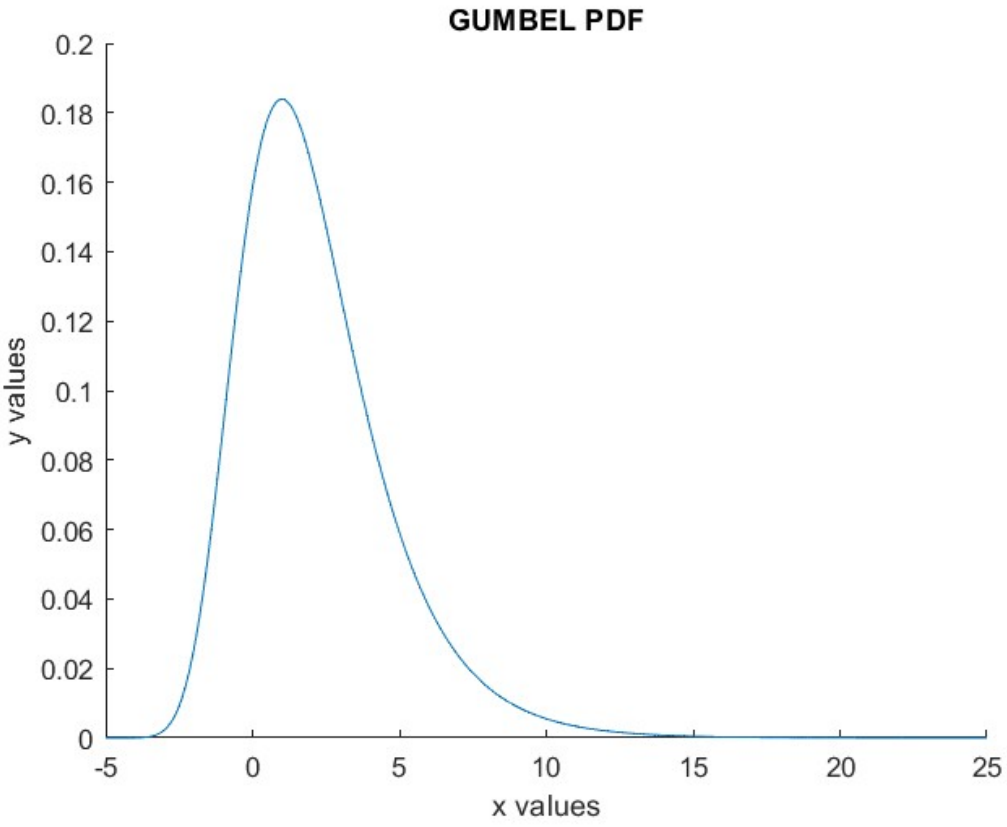
2 Gumbel Distribution

$$F(x;\mu,b) = \frac{1}{\beta}exp(-(z+exp(-z))) \quad where \;\; z = \frac{x-\mu}{\beta}$$

2.1 PDF

Gumbel's Probability distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, scale parameter as b, wrote an array x from -5 to 25, with spacing of 0.1 between each number, wrote y as a function of x, and used plot(x,y) to plot the graph of Laplace PDF from -5 to +25, the peak is at x=0.9, and its maximum value is 0.1837 as per the graph.



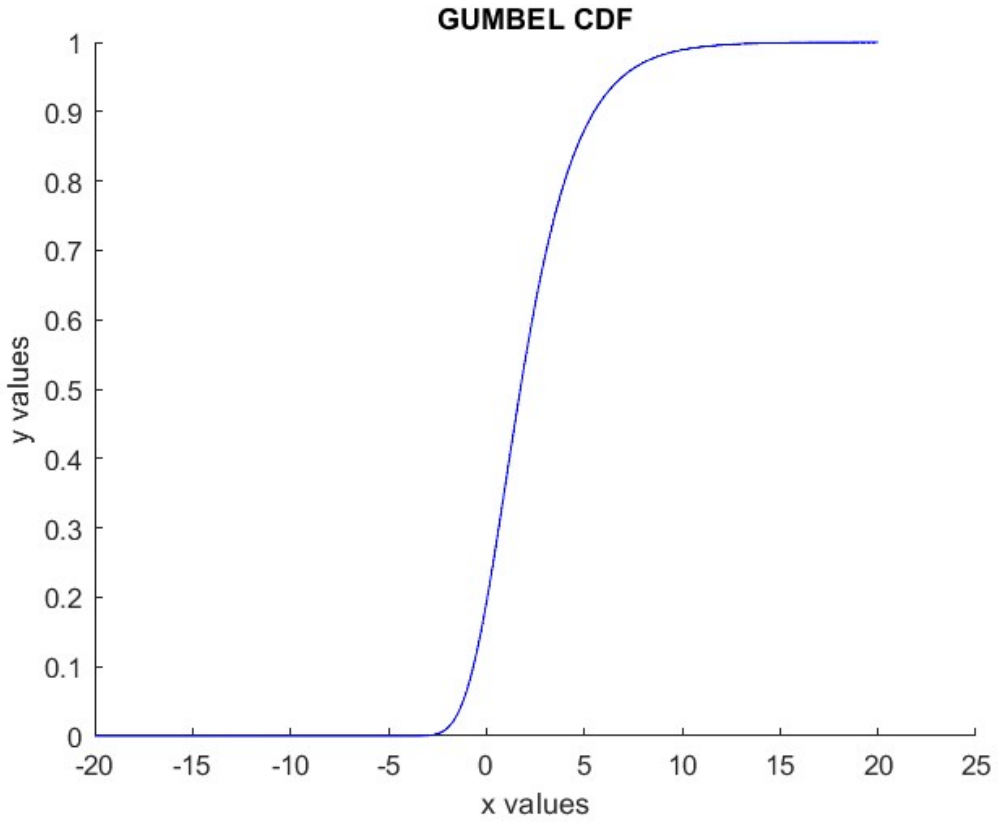
Instructions to run the code:
Run the GUMBELpdf.m file in the code section it gives the same graph as above.

2.2 CDF

Gumbel's Cumulative distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, Scale parameter as b, wrote a linear space xa from -20 to 20 with 4001 steps in between(0.01 gap), drawn the graph slice wise adding the previous values to $yab \times 0.01$, using Riemann sum to find the CDF.

$$y(i+1) = y(i) + (yab(i) \times 0.01)$$



Instructions to run the code:
Run the GUMBELcdf.m file in the code section it gives the same graph as above.

2.3 Variance

Took Location parameter as u, Scale parameter as b, wrote a linear space x, from -10 to 20 with 3001 steps(0.01gap), found var by variance formula, using Riemann sum as given below.

$$var = var + ((x(i) - b)^2 \times y(i) \times 0.01)$$

The results are as below.
calculated variance = 6.573407
variance theoretically = $\frac{\pi^2}{6}\beta^2 = 6.579736$
Deviation from analytically known variance = 0.006330

Instructions to run the code:
Run the GUMBELvar.m file in the code section it gives the same results as above.

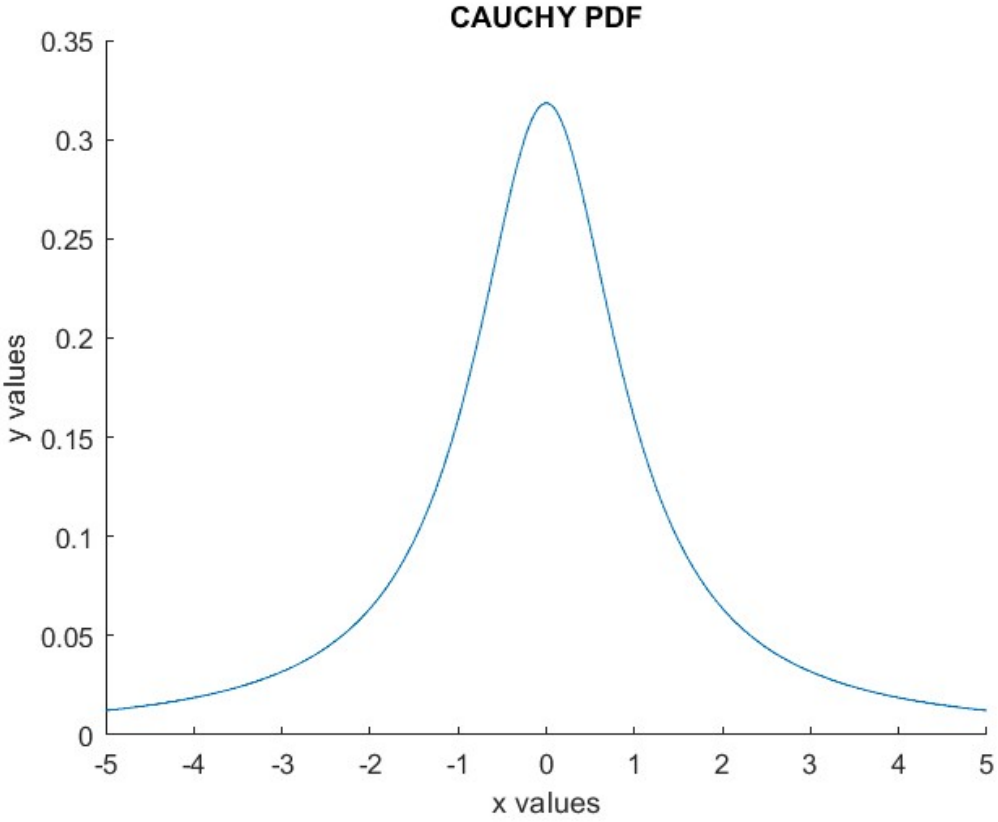
3 Cauchy Distribution

$$f(x;\mu,\gamma) = \frac{1}{\pi\beta}\frac{\gamma^2}{(x-\mu)^2+\gamma^2}$$

3.1 PDF

Cauchy's Probability distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, scale parameter as b, wrote an array x from -5 to 5, with spacing of 0.01 between each number, wrote y as a function of x, and used plot(x,y) to plot the graph of Laplace PDF from -5 to +5, the peak should is at x=0 as it is the Location parameter, and its maximum value is 0.3183 as per the graph.



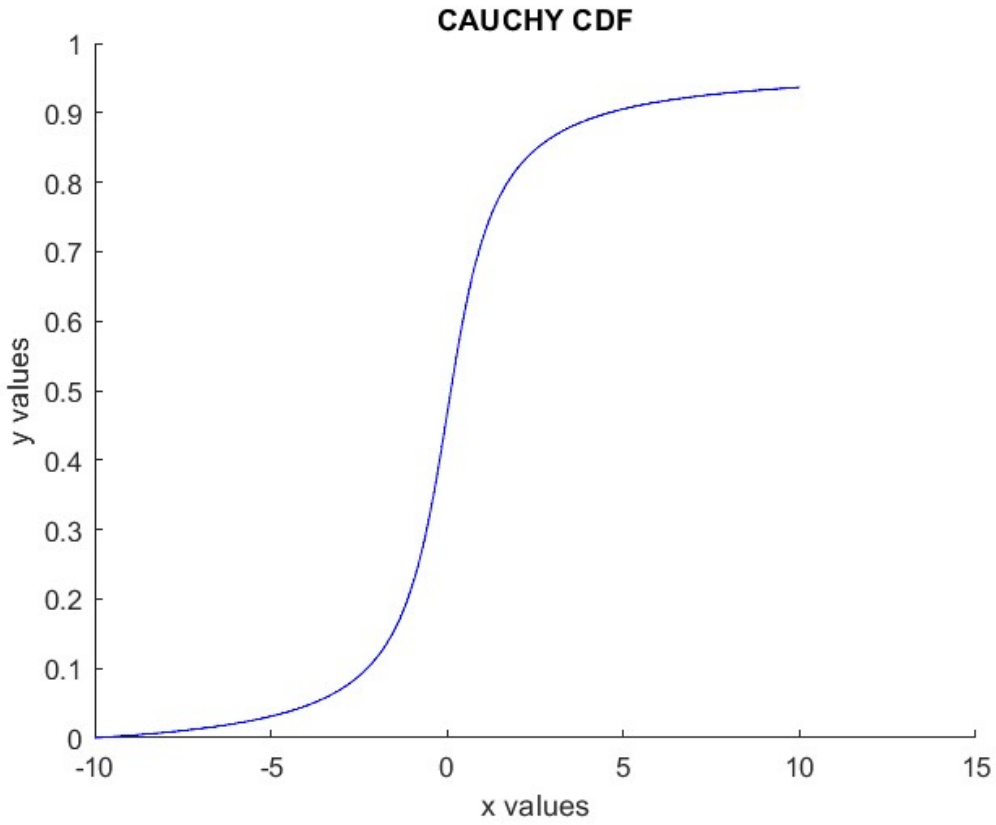
Instructions to run the code:
Run the CAUCHYpdf.m file in the code section it gives the same results as above.

3.2 CDF

Cauchy's Cumulative distribution function graph:

This graph is being drawn using MATLAB, by taking Location parameter as u, Scale parameter as b, wrote a linear space xa from -20 to 20 with 4001 steps in between(0.01 gap), drawn the graph slice wise adding the previous values to y(ab)*0.01 as told to use Riemann sum to find the CDF.

$$y(i+1) = y(i) + (yab(i) \times 0.01)$$



Instructions to run the code:
Run the CAUCHYcdf.m file in the code section it gives the same results as above.