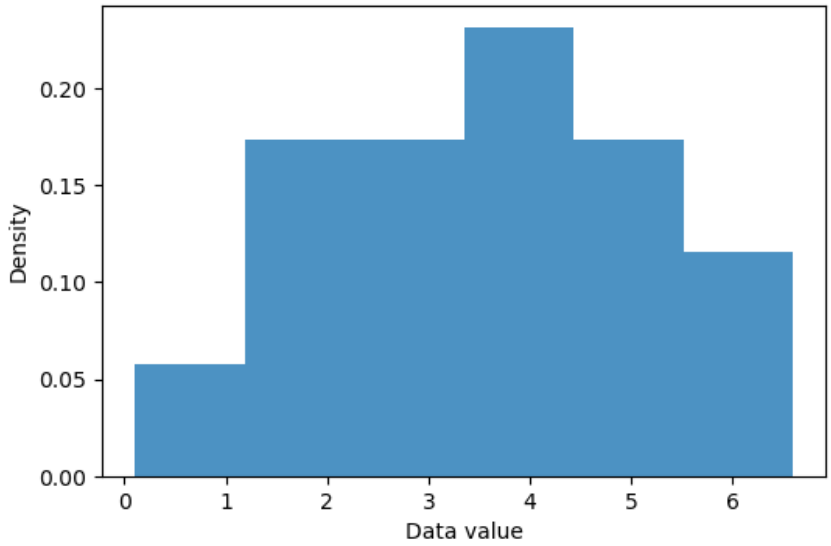
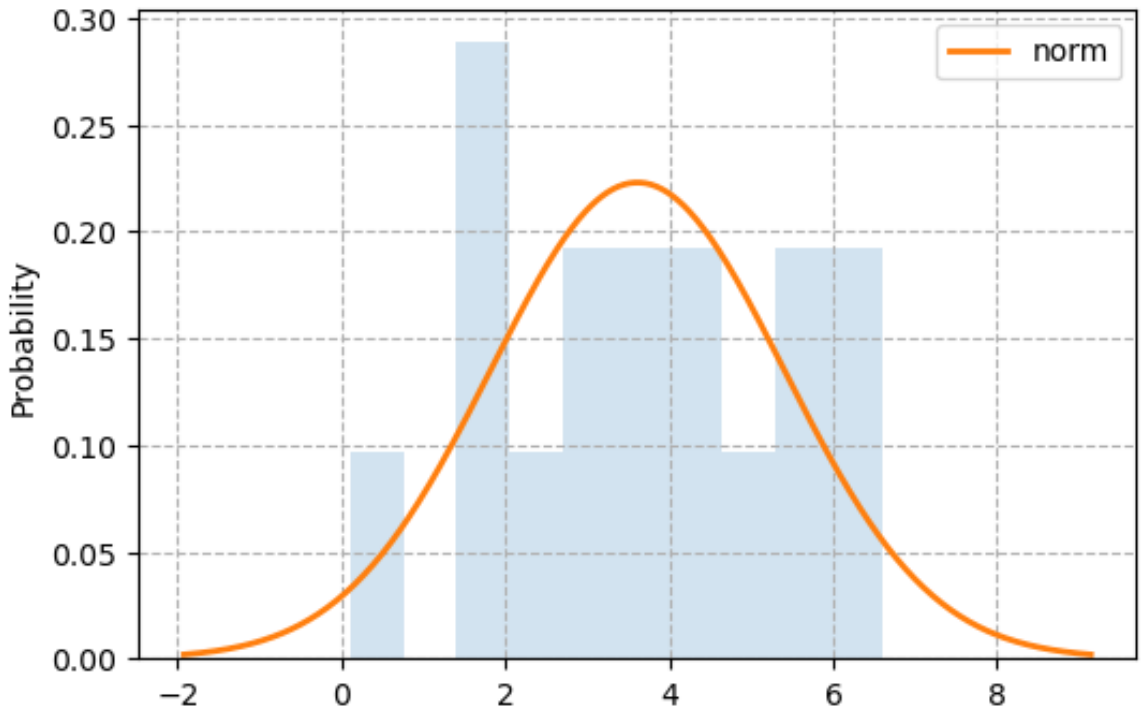
TIE4203 Decision Analysis in Industrial & Operations Management
Solutions to Tutorial #8

Question 1 (P7.1)



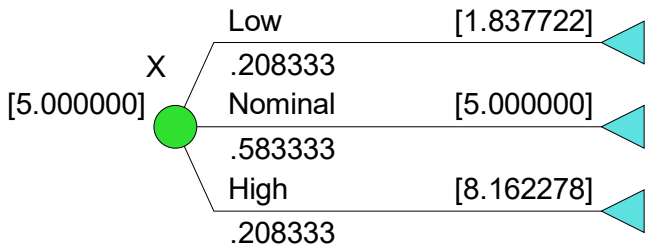
Data Description:
size = 16
minmax = (0.1077, 6.5941)
mean = 3.61086875
var = 3.41809
std dev = 1.7901

The Maximum Likelihood Estimators (MLE) for the mean and standard deviation of the Normal Distribution is the mean and standard deviation of the observed data.
Hence, we will fit a Normal distribution with mean = 3.611 and standard deviation = 1.790

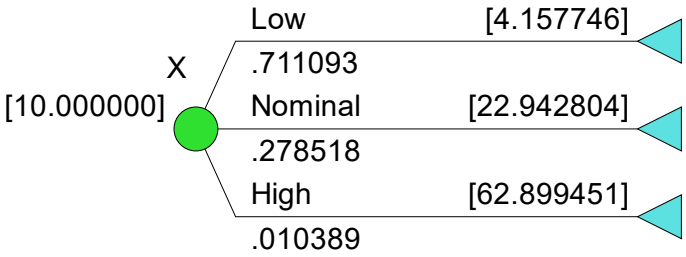


Question 2 (P7.2)

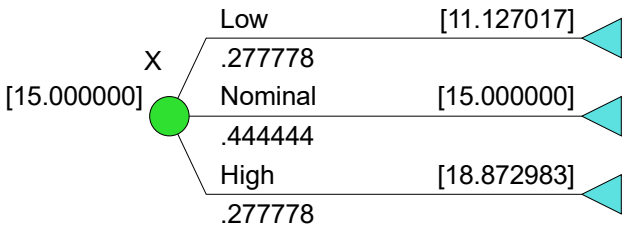
(*a*) Triangular (0, 10, 5)



(*b*) Exponential (1/10)



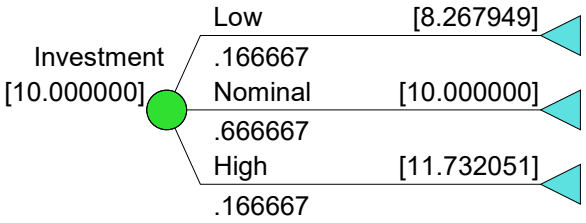
(*c*) Uniform (10, 20)



Question 3 (P7.3)

Let the utility function be $u(x) = 1 - e^{-x/5}$ where x is in millions of dollars.

(*a*) Discrete 3-branch approximation (moments matching) using DPL:



$E[u(x)] = (1/6)\ u(8.267849) + (2/3)\ u(10) + (1/6)\ u(11.732051) = 0.861931$

$CE = u^{-1}(0.861931) = \$\ 9.9000$ millions

(*b*) Stanford/SDG 3-branch quick approximation:

From the CDF, the 10th, 50th, and 90th percentiles are 8.718, 10.0, and 11.282, respectively.

$E[u(x)] = 0.25\ u(8.718) + 0.5\ u(10.0) + 0.25\ u(11.282) \quad = 0.86243$

$CE = u^{-1}(0.86243) = \$\ 9.9181$ millions

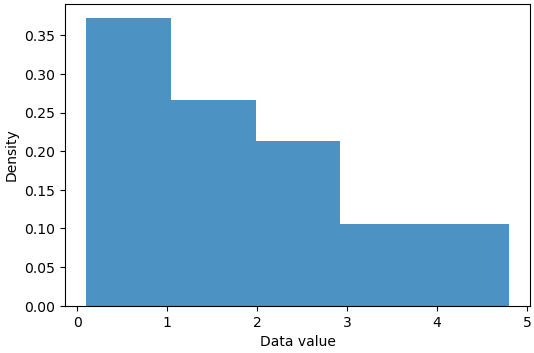
(*c*) Pearson-Tukey 3-branch approximation method:

From the CDF, the 5th, 50th, and 95th percentiles are 8.355, 10.0, and 11.645, respectively.

$E[u(x)] = 0.185\ u(8.355) + 0.63\ u(10.0) + 0.185\ u(11.645) \quad = 0.86193$

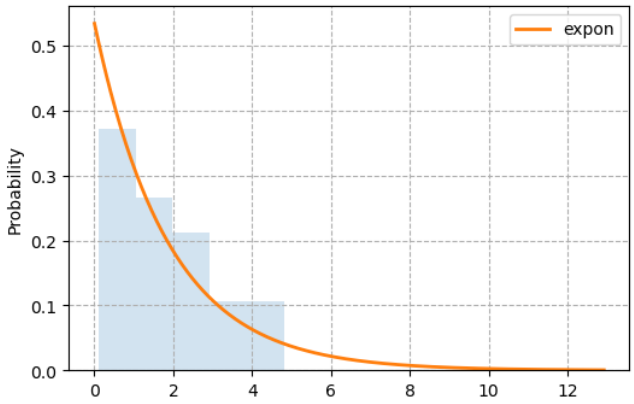
$CE = u^{-1}(0.86193) = \$\ 9.9000$ millions

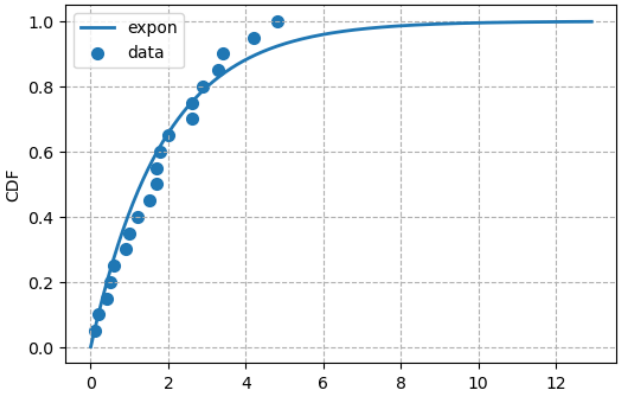
Question 4 (P7.5)



Data Description:
size = 20
minmax = (0.1, 4.8)
mean = 1.8699999999999999
var = 1.8137894736842104
skewness = 0.5802772894968783
kurtosis= -0.5649727424575377

We will fit an exponential distribution with one parameter (location = 0).

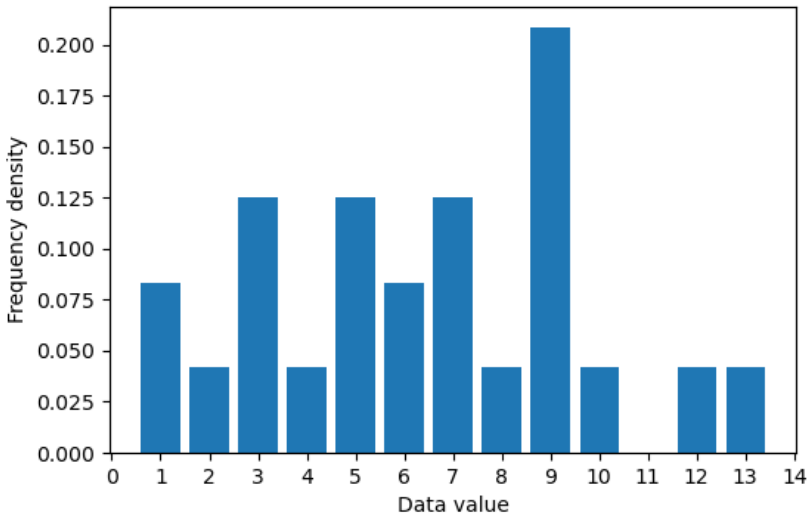




Distribution: expon
Parameters = (0.0000, 1.8700)
KS statistic = 0.15163114014127343
KS p-value = 0.6921603208893784
mean = 1.8700
var = 3.4969
std dev = 1.8700

Question 5 (P7.6)

(*a*) Histogram of the data



Data Description:
size = 24
minmax = (1, 13)
mean = 6.375
var = 10.853260869565217
skewness = 0.1004975735577767
kurtosis= -0.7612716019447299

(*b*) Try fitting the Poisson, Binomial, Negative binomial, and Beta Binomial distributions

The top 2 distributions are:

Distribution: betabinom
Parameters = (1.3050e+01, 2.1898e+00, 2.2715e+00)
KS statistic = 0.13735397910174652
KS p-value = 0.705329716862781
mean = 6.4053
var = 10.4571
std dev = 3.2337

Distribution: nbinom
Parameters = (8.3030e+00, 5.6568e-01)
KS statistic = 0.17272838916584243
KS p-value = 0.4233763247639363
mean = 6.3750
var = 11.2697
std dev = 3.3570

(*c*) Comparing the PMF and CDF of the fitted distributions with the data