Information Theory Report

Alberto Maria Falletta s277978

EXERCISE 1

When the button is clicked the program acquires the values inserted by the user and checks whether one or more fields are empty.
It then proceed in finding the normalization factor by calculating the integral between the given boundaries.
The probability density function is then normalized when divided by the normalization factor since by definition the integral of a pdf computed between its boundaries must be equal to one.
The program then proceed in calculating the differential entropy by the mean of its formula:

$$H\left(X\right) = -\int_{-\infty}^{+\infty} p\left(x\right)\ \log{}_{2} p\left(x\right) dx$$

Finally the gaussian upper bound is computed by mean of its formula.

EXERCISE 2

When the button is clicked the program acquires the values inserted by the user and checks whether one or more fields are empty.
The three probability density functions are then normalized.
The single random variables's entropies are then computed along with the entropy of the function of the three random variables given in input by the user.
This latter entropy is actually a joint entropy and it's computed by mean of its formula.
Finally the inequalities are taken into consideration.
We remember that for an entropy holds the following condition:
0 <= H(X) <= log2(N)
The first is due to the fact that probabilities are always positive quantities therefore the entropy can never be minor with respect to zero being the entropy a sum of positive quantities.
The latter is proven to be the highest value possible for the entropy which is reached if and only if the probability is distributed uniformly.