# Introduction to Computational Physics – Exercise 10

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## Probability Distribution Functions

Consider a probability distribution function $p(x)$ given in the domain $[0, a\rangle$ by

$$p(x) = bx \tag{1}$$

Assume that $\{r_i\}$ is a random set of numbers, distributed uniformly between 0 and 1.

**Task:** Give the proper value of $b$ as a function of $a$ such that the probability distribution function is properly normalized.

**Task:** Use the rejection method to make a set $\{x_i\}$ that obeys Eq. (1) for $a = 0.5$.

**Task:** Make a histogram of the resulting numbers and check that the histogram indeed follows Eq. (1), i.e. overplot Eq. (1). Experiment with the size of the set (the number of random numbers drawn), to find out how large you have to make it to get (by eye) a reasonable fit.

## Determination of $\pi$ with Random Numbers

**Task:** Compute the number $\pi$ using a rejection method with the function $f(x) = \sqrt{1 - x^2}$, for $0 \leq x \leq 1$. *Hint:* It is enough to use only one quadrant $x$, $f(x) > 0$. Vary the number of random numbers (RNs) widely (orders of magnitude) and plot the accuracy of the result as a function of the number of RNs. Use logarithmic variables for the plot.