**Probability** (for background see 3.pdf, which is Ch. 3 of the stats book)

a) Definition of probability
   i) Sample space S containing finite number of points $s_i$ $(i = 1, ..., n)$
   ii) $p_i > 0 \; for$ i $= 1, \ldots,$ n and $\sum_{i=0}^{n} p_i = 1$

b) Negation
   i) $\sim p_i = 1 - p_i$

c) Independence
   i) $\Pr(AB) = \Pr(A)\Pr(B)$

d) Conditional Probability
   i) $\Pr(A \mid B) = \dfrac{\Pr(AB)}{\Pr(B)}$
      (1) Conditional probability that A has occurred given that B has occurred (proportion of events within A and B)
      (2) Or … outcomes in event B that also belong to event A

e) Bayes rule
      (1) Let the events $A_1, ..., A_k$ form a partion of the space S such that $\Pr(A_j) > 0$ for $j = 1, ..., k$ and let B be any event such that $\Pr(B) > 0$, then

$$\Pr(A_i|\mathrm{B}) = \frac{\Pr(A_i)\Pr(B|A_i)}{\sum_{j=1}^{k}\Pr(A_j)\Pr(B|A_j)} = \frac{\Pr(A_i)\Pr(B|A_i)}{\Pr(B)}$$

      (2) $\Pr(A_i)$ is the prior, $\Pr(A_i \mid B)$ is the posterior.

**Random variables**

   i) "a random variable is a quantity whose values are random and to which a probability distribution is assigned" or
   ii) . "… a measurable function from a sample space to the measurable space of possible values of the variable." (Wikipedia)
   iii) Set of possible outcomes resulting from a sampling of an event.

**Distribution Functions**

a) Probability Distribution Function (pdf)
      (1) Function $f(x)$ describing probability of getting various values of x:

Requires that $\int_{-\infty}^{\infty} f(u)du = 1$

b) Cumulative Distribution Function (cdf)
Function $F(x)$ describing cumulative probability of getting various values of x:

$$F(x) = P(X < x) = \int_{-\infty}^{x} f(u)du$$

Simulating arbitrary CDF:

1. Draw random number R between 0 and 1.
2. Find x coordinate of CDF that corresponds to y coordinate of R.
3. Repeat for each desired sample.

Example:

g(x) = 1, 2, 3 or 4;
f(x) = .1 * x
Draw f(x), F(x), take samples