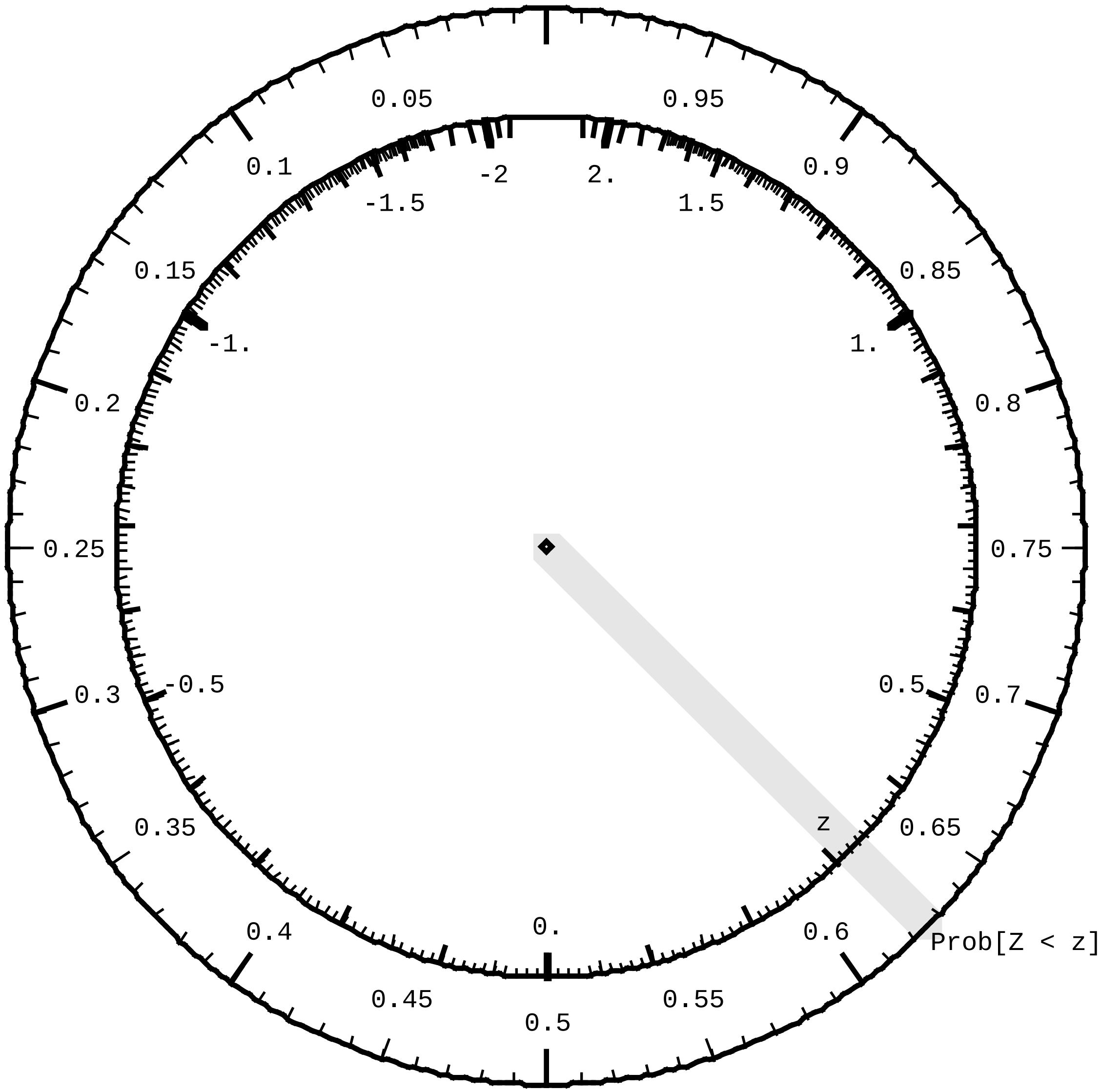
Generating random numbers from a Gaussian Distribution / Connections with the Normal (Gaussian) Tables



Imagine a disk or "Spinner" with 2 concentric circles, and a spindle through the centre. Suppose that when spun it is equally likely to come to rest at any point on the outer circumference. This is reflected in markings of 0 to 1 (or, if you prefer, % to 100%) uniformly on the circumference of the outer circle.

Q: How should we mark the circumference of the inner circle so that repeated spins produce values with a Gaussian N(0,1) distribution? [see "spinner" in fig 4.9 page 317 of M&M]

A: Use the z values corresponding to the percentiles of the Gaussian Distribution!

Then, the spinner shown will produce Z values from minus to plus infinity..

IMPLICATIONS FOR MONTE CARLO (SIMULATION) WORK

1 Generate numbers with a Uniform Distribution on (0,1)

e.g. in Excel use the RAND() function

i.e. generate P = RAND()

2 Calculate percentile corresponding to P

i.e. z = Z value such that Prob(Z < z) = P

in Excel, use NORMINV function,

i.e.
calculate z = NORMINV(P,μ=0,σ=1)

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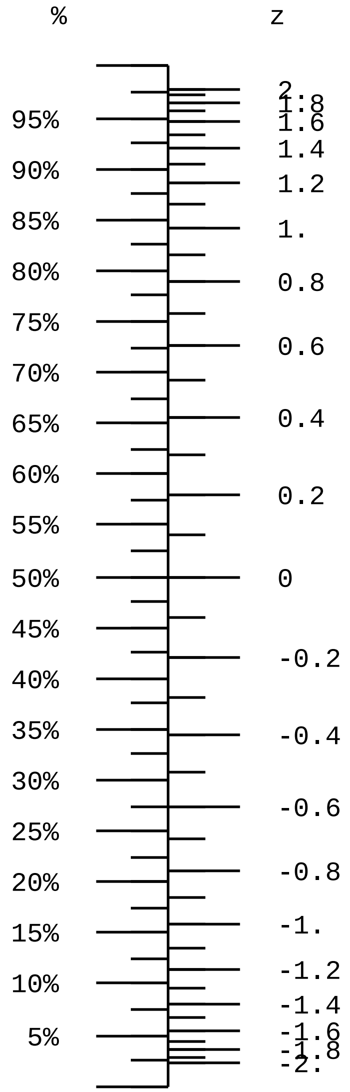
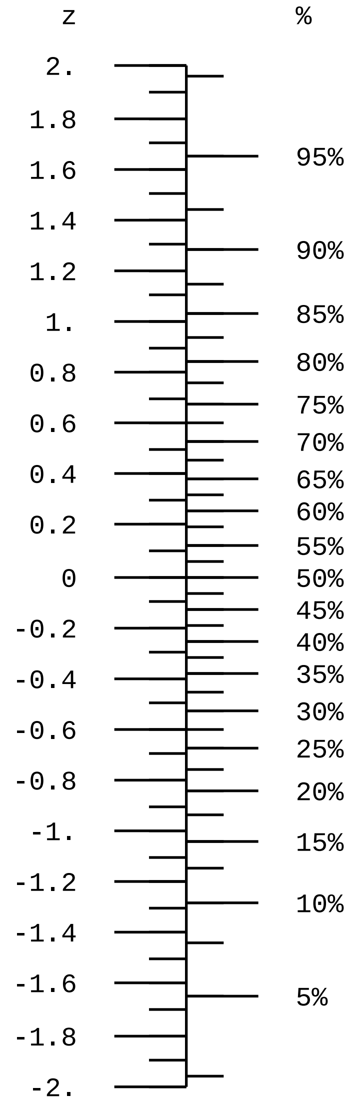
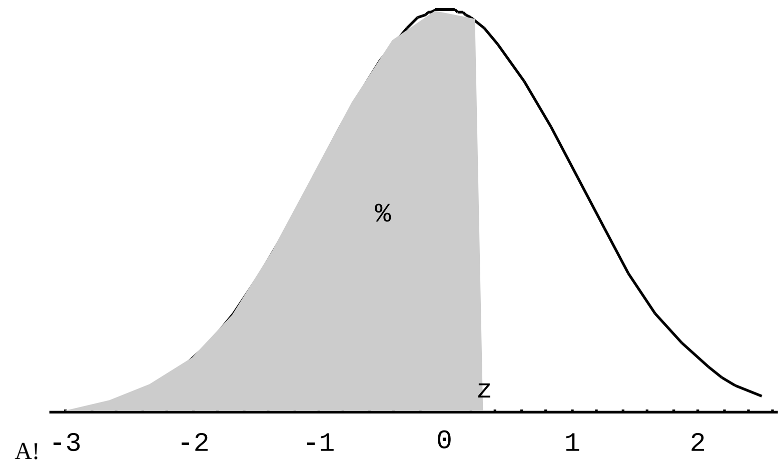
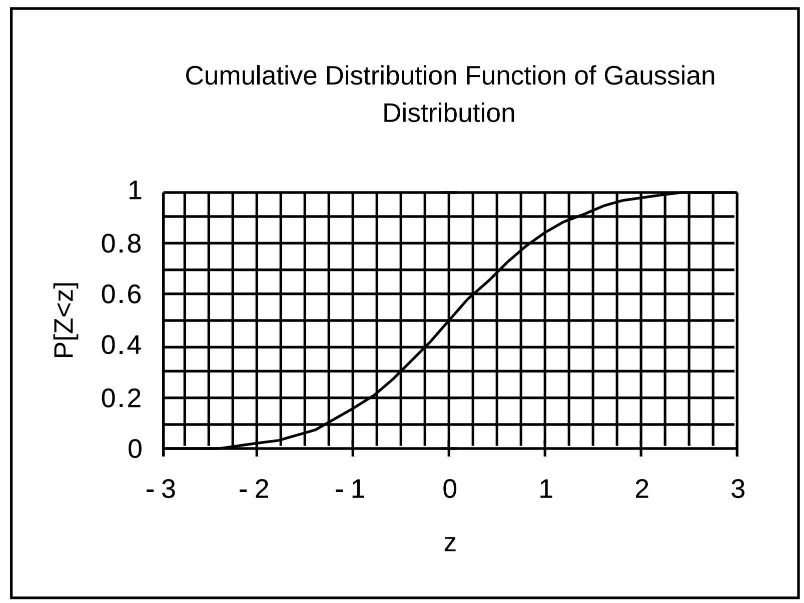






Another way of visualizing the Table is given below. To generate a random Z, enter randomly at the vertical axis and find corresponding Z value!



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The above **nomograms** illustrate the same idea: the function links the shaded area under the Gaussian curve with the corresponding z value. I t is shown , first with area or Percent or Pr(Z<z) as a function of z, and then vice-versa (as is done in Table A of M&M). Table A tabulates Prob[Z<z] as a function of z, but one can travel in either direction.