

# Matlab's normcdf and norminv functions

Matlab has two useful functions called normcdf and norminv.

normcdf( $a$ ) returns  $\text{NA}(-\infty, a)$ , that is, the area under the normal density curve from  $-\infty$  to  $a$ . Note: normcdf stands for “cumulative distribution function of the normal distribution,” which is equal to  $\text{NA}(-\infty, a)$ . In general, a cumulative distribution function  $F$  for a continuous random variable  $z$  gives  $F(a) = P(z < a)$ .

normcdf( $a, m, s$ ) is used when we have not standardized our normal distribution, and  $a$  is a value of  $X$ , where  $X$  is normally distributed with mean  $m$  and standard deviation  $s$ . In other words,  $\text{normcdf}(a, m, s) = \text{NA}(-\infty, \frac{a-m}{s})$ .

You can also use normcdf on vectors, and it just computes normcdf for each coordinate in a vector. You can then use this to find  $\text{NA}(a, b)$  by subtracting the two values.

Examples:

$$\text{normcdf}(0) = 0.5000$$

$$\text{normcdf}(1) = 0.8413$$

$$\text{normcdf}(90, 100, 4) = 0.0062$$

$$\text{normcdf}([-1 \ 1]) = [.1587 \ .8413]$$

$$\text{normcdf}([-2 \ 2]) = [.0228 \ .9772]. \text{ Note that from here we can find } \text{NA}(-2, 2) = .9772 - .0228 = .9544.$$

$$\text{normcdf}([80 \ 120], 100, 10) = [.0228 \ .9772] \text{ also.}$$

norminv is the inverse function of normcdf. If  $p = \text{normcdf}(a)$ , then  $\text{norminv}(p) = a$ . norminv( $p$ ) gives the value  $a$  such that  $p = \text{NA}(-\infty, a)$ .

Examples:

$$\text{norminv}(.5) = 0$$

$$\text{norminv}(.9) = 1.2816$$

$$\text{norminv}([.025 \ .975]) = [-1.9600 \ 1.9600] \text{ Note that this gives the z-values of a 95\% confidence interval.}$$

$$\text{norminv}([.1 \ .9]) = [-1.2816 \ 1.2816]$$

$\text{norminv}([.1 \ .9], 100, 10) = [87.1845 \ 112.8155]$ . This gives an 80% confidence interval for  $X$  when the mean of  $X$  is 100 and the standard deviation of  $X$  is 10.

$$\text{norminv}(1) = \infty$$

Between these two functions, you should be able to do everything you could with your normal table. You should, of course, know how to use your table as well, since it's all you'll be able to use on the final exam.