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6.12 Ulnar Variance (3 points)

This exercise uses data reported in Jung et al. (2001), who studied radiographs of the wrists of 120 healthy volunteers in order to determine the normal range of ulnar variance, Fig. 6.20. The radiographs had been taken in various positions under both unloaded (static) and loaded (dynamic) conditions. The ulnar variance in neutral rotation was modeled by normal distribution with a mean of mu =0.74mm and standard deviation of sigma =1.46mm.

```
mu = 0.74;
sigma = 1.46;

% (a) What is the probability that a radiogram of a normal person will
% show negative ulnar variance in neutral rotation (ulnar variance, unlike
% the statistical variance, can be negative)?

% Find: P(X<0)
P0 = normcdf(0,0.74,1.46); %0.3061

% The researchers modeled the maximum ulnar variance (UVmax) as normal
% N(1.52, 1.562) when gripping in pronation and minimum ulnar variance
% (UVmin) as normal N(0.19, 1.432) when relaxed in supination.

% (b) Find the probability that the mean dynamic range in ulnar variance,
% C = UVmax ? UVmin, will exceed 1mm.
P1 = 1-normcdf(1, 1.52 - 0.19, sqrt(1.562^2 + 1.432^2)); %0.5619
```

6.15 Amount of Liquid in a Bottle (3 points)

Suppose that the volume of liquid in a bottle of a certain chemical solution is normally distributed with a mean of 0.5L and a standard deviation of 0.01L.

```
mu = 0.5;
sigma = 0.01;

% (a) Find the probability that a bottle will contain at least .48L of
% liquid
% p = P(X>x0) = 1-P(X<= x0)
p = 1-normcdf(.48,mu,sigma); %p = 0.9772

% (b) Find the volume that corresponds to the 95th percentile
vol = norminv(1-.05, mu, sigma); % vol = 0.5164 L
```

7.8 Match the Moment (4 points)

The geometric distribution (X is the number of failures before the first success) has a probability mass function of f(x|p) = (q^x)*p, x = 0,1,2, . . . Suppose X1,X2, . . . ,Xn are observations from this distribution. It is known that EXi = (1-p)/p .

```
% (a) What would you report as the moment-matching
% estimator if the sample X1 = 2, X2 = 6, X3 = 1 were observed?

% EX = (1-p)/p, where p is probability of success on each trial
Xbar = mean([2, 6, 1]);
Pmm = 1/(Xbar + 1); % Pmm = .25

% (b) What is the MLE for p?
pmle = mle([2, 6, 1], 'distribution', 'geometric'); %0.25
```

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