

# Quiz 3

*Name:*

For the following problems state the distribution used and the reason.

1. A widget manufacturer has promised a 0.1% defect rate. You test out 100 widgets and find one defect.
  - a. Assuming the stated defect rate, what is the probability of finding one or more defect in 100 widgets?
  - b. Assuming the stated defect rate, what is the expected number of widgets you would have to test to find a defective one?
  - c. If you were to four batches of 100 widgets, what is the probability that none of the batches contains at least one defective widget?

Binomial( $n, p$ ):  
 pmf:  $f(x) = \binom{n}{x} p^x (1-p)^{n-x}$   
 expectation:  $np$   
 variance:  $np(1-p)$

Poisson( $\lambda$ ):  
 pmf:  $f(x) = \lambda^x e^{-\lambda} / x!$   
 expectation:  $\lambda$   
 variance:  $\lambda$

Geometric( $p$ ):  
 pmf:  $f(x) = (1-p)^x p$   
 expectation:  $\frac{1}{p} - 1$   
 variance:  $\frac{1-p}{p^2}$

Negative Binomial( $r, p$ ):  
 pmf:  $f(x) = \binom{x+r-1}{x} p^x (1-p)^r$   
 expectation:  $\frac{pr}{1-p}$   
 variance:  $\frac{pr}{(1-p)^2}$

Hypergeometric( $N_1, N_2, n$ ):  
 pmf:  $f(x) = \frac{\binom{N_1}{x} \binom{N_2}{n-x}}{\binom{N_1+N_2}{n}}$   
 expectation:  $nN_1 / (N_1 + N_2)$   
 variance:  $n \frac{N_1}{N_1+N_2} \frac{N_2}{N_1+N_2} \frac{N_1+N_2-n}{N_1+N_2-1}$