Discussion 7

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38 A manufactured lot of buggy whips has 20 items, of which 5 are defective. A random sample of 5 items is chosen to be inspected. Find the probability that the sample contains exactly one defective item

(a) if the sampling is done with replacement.

If the sampling is done with replacement this can be solved using binomial

$$P(X = k) = \binom{n}{k} p^k (1-p)^{n-k}$$

```
p <- 5/20
n <- 5
k <- 1
nChooseK <- factorial(n) / (factorial(k) * factorial(n -k))

(nChooseK * p ^ k * (1 - p)^(n -k))
```

```
## [1] 0.3955078
```

```
#check answer
dbinom(1,5,.25)
```

```
## [1] 0.3955078
```

(b) if the sampling is done without replacement.

Without replacement then we use a hypergeometric formula

$$P(X = k) = \frac{\binom{K}{k}\binom{K-k}{n-k}}{\binom{N}{n}}$$

N is the population size, K is the number of success states in the population, n is the number of draws (i.e. quantity drawn in each trial), k is the number of observed successes.

```
K <- 5
k <- 1
N <- 20
n <- 5
(choose(K,k) * choose(N - K,n - k)) / choose(N,n)
```

```
## [1] 0.440209
```

```
#check answer
dhyper(1,5,15,5)
```

```
## [1] 0.440209
```