

Generative Models for Discrete Data

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Exercises

1.1

Geometric Distribution:

Given a probability p , how many failures will it take to see the first success?

```
# A random sample of size 5 from a geometric distribution with p=.25  
rgeom(5, .25)
```

```
## [1] 0 3 0 3 0
```

```
# What is the probability that we will see 4 failures before the first success?  
dgeom(4, .25)
```

```
## [1] 0.07910156
```

```
# What is the probability that we will see no more than 3 failures before the first success?  
pgeom(3, .25)
```

```
## [1] 0.6835938
```

Hypergeometric Distribution:

Given a population of size N where K of the N objects are “success states.” How many success state objects will I obtain (k) from drawing a sample of size n without replacement?

```
# A random sample of size 5 from a hyper geometric distribution with a population of N=25, K=5 success  
rhyper(5, 5, 20, 10)
```

```
## [1] 1 2 2 2 3
```

```
# What is the probability that we will see 5 success state objects?  
dhyper(5, 5, 20, 10)
```

```
## [1] 0.004743083
```

```
# What is the probability that we will see at least 1 success state object?  
phyper(0, 5, 20, 10, lower.tail = F)
```

```
## [1] 0.9434783
```

1.2

$P(X = 2 \mid X \sim \text{Bin}(10, .3))$

```
dbinom(x = 2, size = 10, p = .3)
```

```
## [1] 0.2334744
```

$P(X \leq 2 \mid X \sim \text{Bin}(10, .3))$

```
# Using only dbinom()  
dbinom(x = 0, size = 10, p = .3) + dbinom(x = 1, size = 10, p = .3) + dbinom(x = 2, size = 10, p = .3)
```

```
## [1] 0.3827828
```

```
# Using pbinom()  
pbinom(q = 2, size = 10, p = .3)
```

```
## [1] 0.3827828
```