R probability commands

Binomial, Poisson, and Normal Distributions

Stat 251 Spring 2019

The Binomial distribution

In shorthand notation:

$$X \sim B(n, p)$$

For our example here:

$$X \sim B(10, 0.55)$$

`R` code for the binomial:
`dbinom(x,n,p)` where x is the argument, n is the sample size, and p is the probability of success

Find the probability that there are exactly 0 successes

$$P(X = 0)$$

```
dbinom(0,10,0.55)
```

```
[1] 0.0003405063
```

Find the probability that there are exactly 5 successes

$$P(X = 5)$$

```
dbinom(5,10,.55)
```

```
[1] 0.2340327
```

Find the probability that there are between 2 and 4 successes

$$P(2 <= X <= 4) = P(2) + P(3) + P(4)$$

Here the `sum()` command is needed for a range of values. The range is denoted as `2:4`, as in 'between 2 and 4'

```
sum(dbinom(2:4,10,.55))
```

```
[1] 0.2570605
```

The Poisson distribution

In shorthand notation:

$$X \sim P(\mu)$$

For our example here (say that the average number of accidents along a certain highway are 3 per week):

$$X \sim P(3)$$

`R` code for poisson:
`dpois(x,mu)` where x is the argument and mu is the mean

Find the probability that there are 0 successes (0 accidents in the next week)

$$P(X = 0)$$

```r
dpois(0,3)
```

```
[1] 0.04978707
```

Find the probability that there are exactly 5 accidents in the next week

$$P(X = 5)$$

```r
dpois(5,3)
```

```
[1] 0.1008188
```

Find the probability that there is at least one accident in the next week #### Note that the complement rule is needed since $0 \leq x < \infty$

$$P(X \geq 1) = 1 - P(X < 1) = 1 - P(X = 0)$$

```r
1-dpois(0,3)
```

```
[1] 0.9502129
```

Find the probability that there are between 2 and 4 accidents in the next week

$$P(2 \leq X \leq 4) = P(2) + P(3) + P(4)$$

```r
sum(dpois(2:4,3))
```

```
[1] 0.616115
```

Normal distribution

In shorthand notation:

$$X \sim N(\mu, \sigma)$$

where mu (μ) is the mean and sigma (σ) is the standard deviation

For our example here:

$$X \sim N(72.6, 4.78)$$

`R` code for the normal:
`pnorm(x,mu,sigma)` where x is the argument, mu is the mean, and sigma is the standard deviation. `pnorm()` works just like the table, as in area to the left. Must use complement rule for area to the right

Find the probability that the speeds of drivers on I-5 is less than 80 mph

$$P(X < 80) = P(X \leq 80)$$

```
pnorm(80,72.6,4.78)
```

```
[1] 0.939203
```

Find the probability that the speeds of drivers on I-5 is between 60 and 80 mph

$$P(60 < X < 80)$$

```
pnorm(80,72.6,4.78)-pnorm(60,72.6,4.78)
```

```
[1] 0.9350083
```

Find the probability that the speeds of drivers on I-5 is more than 70 mph

$$P(X > 70)$$

```
1-pnorm(70,72.6,4.78)
```

```
[1] 0.7067562
```

Find the speed that represents the top 5% of speeds (remember that the top 5%=bottom 95%)

We will need to use `qnorm(%,mu,sigma)` and it will find the value of X rather than a probability

```
qnorm(.95,72.6,4.78)
```

```
[1] 80.4624
```