R Commands for Inference for Proportions

Suppose we take a sample of size $n = 40$ and our null hypothesis is $H_0 : p = 0.2$

If the null hypothesis is true and conditions check out, our sampling distribution is $X \sim \text{Binomial}(40, 0.2)$

There are 3 options for what H_A could be:

Option 1: $H_A : p > 0.2$ (do not use this confidence interval)

Suppose that we observe $x = 14$. The p-value is $P(X \geq 14) = P(X > 13)$.

```
pbinom(q = 14 - 1, size = 40, prob = 0.2, lower.tail = FALSE)
```

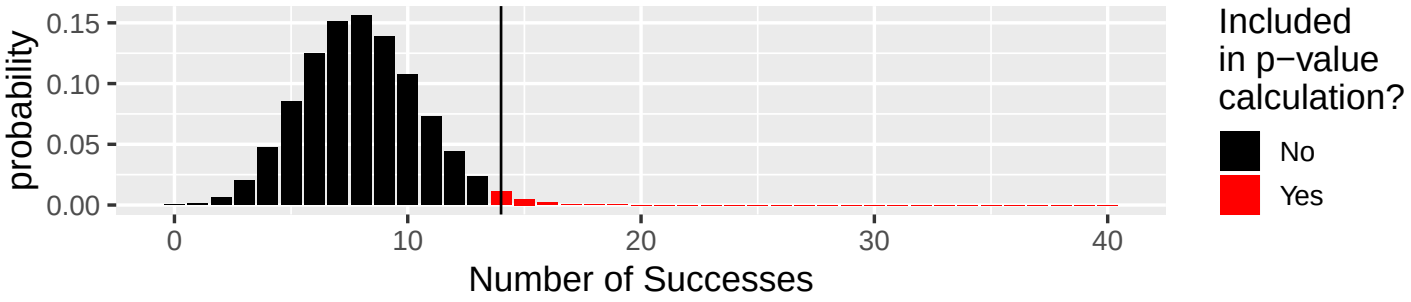
```
## [1] 0.01940737
```

```
binom.test(x = 14, n = 40, p = 0.2, alternative = "greater")
```

```
##
##  data:  14 out of 40
##  number of successes = 14, number of trials = 40, p-value = 0.01941
##  alternative hypothesis: true probability of success is greater than 0.2
##  95 percent confidence interval:
##   0.2255325 1.0000000
##  sample estimates:
##  probability of success
##                    0.35
```

Ignore this: we will not use 1-sided confidence intervals

This is the sample proportion: 14/40



Option 2: $H_A : p < 0.2$ (do not use this confidence interval)

Suppose that we observe $x = 6$. The p-value is $P(X \leq 6)$.

```
pbinom(q = 6, size = 40, prob = 0.2)
```

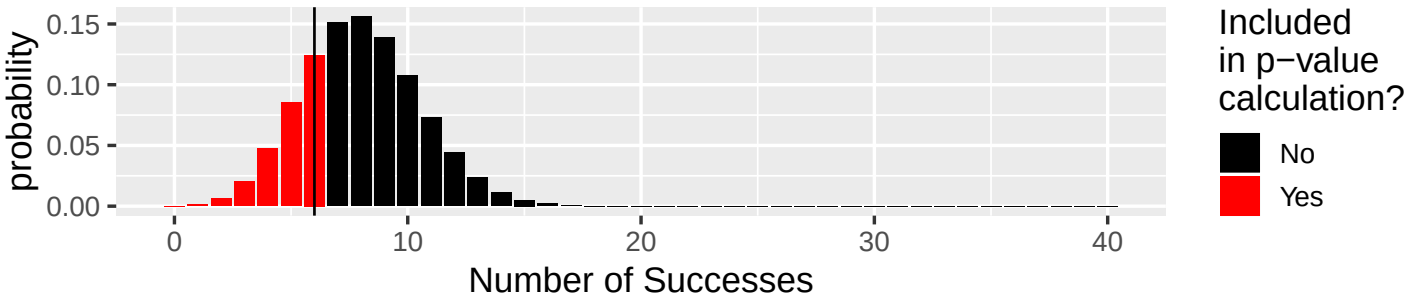
```
## [1] 0.2858914
```

```
binom.test(x = 6, n = 40, p = 0.2, alternative = "less")
```

```
## data:  6 out of 40
## number of successes = 6, number of trials = 40, p-value = 0.2859
## alternative hypothesis: true probability of success is less than 0.2
## 95 percent confidence interval:
##  0.0000000 0.2747445
## sample estimates:
## probability of success
##                   0.15
```

Ignore this: we will not use 1-sided confidence intervals

This is the sample proportion: 6/40



Option 3: $p \neq 0.2$, Confidence Interval

Suppose we observe $x = 14$. The p-value is the probability of getting a test statistic at least as far from the expected result if the null hypothesis was true. We will only use the `binom.test` function for p-value calculations in this case.

```
binom.test(x = 14, n = 40, p = 0.2, alternative = "two.sided",
  conf.level = 0.95)
```

```
## data:  14 out of 40
## number of successes = 14, number of trials = 40, p-value = 0.02735
## alternative hypothesis: true probability of success is not equal to 0.2
## 95 percent confidence interval:
##  0.2062825 0.5168445
## sample estimates:
## probability of success
##                   0.35
```

We will use this confidence interval!