Tongue Roll Activity

Oliver d' Pug

1) How many people are in the classroom with you now?

```
(n <- 16)
```

```
## [1] 16
```

2) How many of them can roll their tongue?

```
(x <- 14)
```

```
## [1] 14
```

3) What is the proportion of students who can roll their tongue, using the people in the classroom as the sample? Use correct notation with your answer.

```
(p_hat <- x/n)
```

```
## [1] 0.875
```

4) What quantity are we estimating if we use this information to construct a confidence interval? Use correct notation and define the parameter. What is a reasonable population?

p is the population proportion of individuals who can roll their tongue. A reasonable population would be...

5) Use the information to construct a 95% confidence interval for the parameter defined in #4. Interpret the result.

```
(z_star <- qnorm(c(0.025,0.975),0,1))
```

```
## [1] -1.959964  1.959964
```

```
(se <- sqrt(p_hat*(1-p_hat)/n))
```

```
## [1] 0.08267973
```

```
p_hat + z_star*se
```

```
## [1] 0.7129507 1.0370493
```

Was n large?

```
n*p_hat >= 10 & n*(1-p_hat) >= 10
```

```
## [1] FALSE
```

It looks like we have a problem. Maybe the bootstrap is a better approach.

```
### Bootstrap of the proportion of the data from above.
### Make sure that the boot package is installed using
### install.packages("boot"), or use a package like pacman to take care
### of installation and loading.
#library(boot)
p_load(boot)
```

```r
  ### Make the observed data
  obs <- c(rep(1,x),rep(0,n-x))
  obs
```

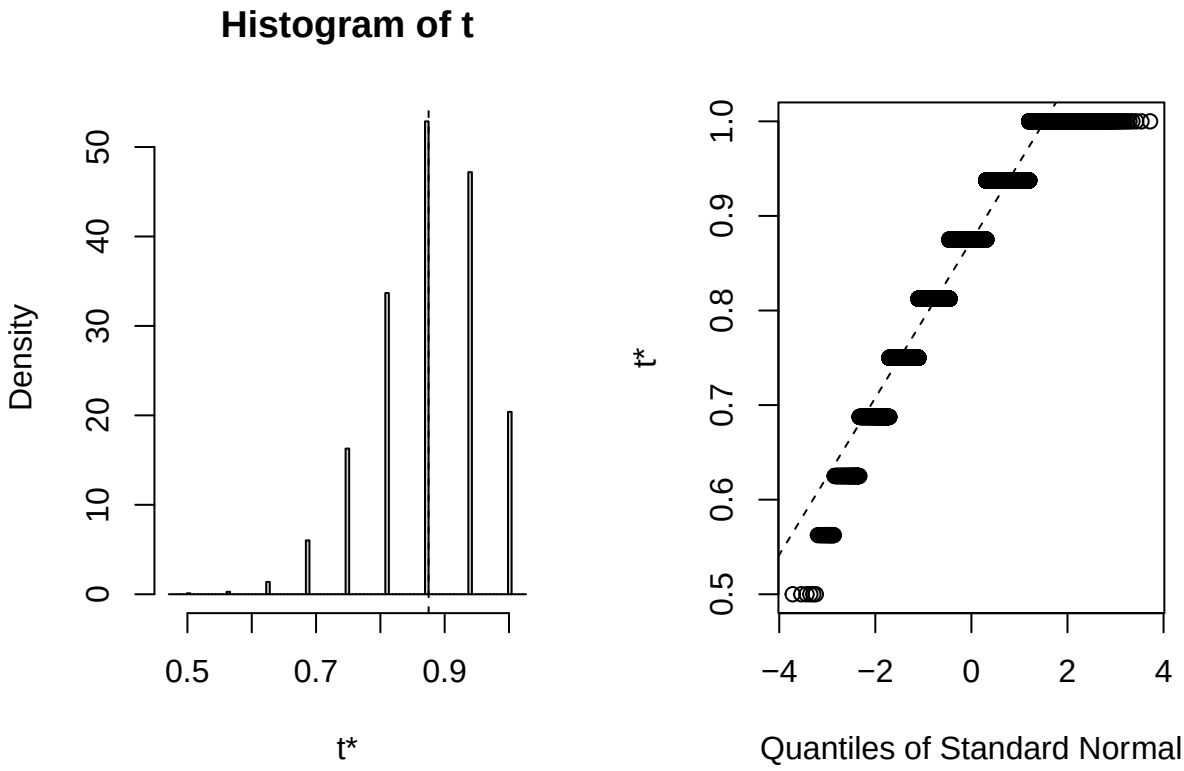
```
##  [1] 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0
```

```r
  ### Define the proportion function with data, d, and boot sample indices, i.
  mystat <- function(d, i){
                           sum(d[i])/length(d[i])
                          }

  ### Use the boot function to run the bootstrap
  boots <- boot(obs, mystat, R=9999)
  boots
```

```
##
## ORDINARY NONPARAMETRIC BOOTSTRAP
##
##
## Call:
## boot(data = obs, statistic = mystat, R = 9999)
##
##
## Bootstrap Statistics :
##     original       bias    std. error
## t1*    0.875 -0.001343884  0.08299544
```

```r
  plot(boots)
```




```
  ### Get 95% CI
  boot.ci(boots, 0.95, type=c("norm","perc"))
```

```
## BOOTSTRAP CONFIDENCE INTERVAL CALCULATIONS
## Based on 9999 bootstrap replicates
##
## CALL :
## boot.ci(boot.out = boots, conf = 0.95, type = c("norm", "perc"))
##
## Intervals :
## Level      Normal             Percentile
## 95%   ( 0.7137,  1.0390 )   ( 0.6875,  1.0000 )
## Calculations and Intervals on Original Scale
```

(6) Tongue rolling has been said to be a dominant trait, in which case theoretically 75% of all people should be able to roll their tongues. Do our data provide evidence otherwise?

$H_0 : p = 0.75$ vs. $H_A : p \neq 0.75$

Is n "large"?

```
  n*p_hat >= 10 & n*(1-p_hat) >= 10
```

```
## [1] FALSE
```

We will ignore this for now and proceed with the normal test.

```
  (p0 <- 0.75)
```

```
## [1] 0.75
```

```
  (alpha <- c(0.1, 0.05, 0.01))
```

```
## [1] 0.10 0.05 0.01
```

```
  (z <- (p_hat - p0)/sqrt(p0*(1-p0)/n))
```

```
## [1] 1.154701
```

```
  (p_value <- 2*pnorm(-abs(z)))
```

```
## [1] 0.2482131
```

```
  reject_H0 <- (p_value <= alpha)
  cbind(alpha, reject_H0)
```

```
##      alpha reject_H0
## [1,]  0.10         0
## [2,]  0.05         0
## [3,]  0.01         0
```

Note that $p = 0.75$ **is** in the bootstrap confidence interval (0.6875, 1) that we found above, so we would not reject the plausible value.