Using R as a Calculator (on the final exam)[1]

STA 260 Spring 2020

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R is a wonderful calculator

- You are going to have access to a computer during the final exam anyway.
- Even a cell phone will do.
- You may already have it and know how to use it.
- Free download at `https://www.r-project.org`
- Run free online at `https://rdrr.io/snippets`

R is a Basic Calculator

```
> 1+1
[1] 2
```

```
> 1:40
 [1]  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
[21] 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
```

R is an advanced calculator

```
> n = 50; xbar = 1.56
> Gsq = 2*n*(xbar*log(xbar) - (1+xbar)*(log(1+xbar)-log(2))); Gsq

[1] 6.174808
```

No More Tables

We will use R for CDFs and quantiles of all the familiar distributions.

- Critical values.
- p-values.
- Posterior probabilities.

Normal Distribution
Faster than the table

```
> pnorm(0) # CDF of standard normal
```

```
[1] 0.5
```

You can specify μ and σ (not σ^2).

IQ tests are designed to have $\mu = 100$ and $\sigma = 15$. What's $P(IQ > 160)$?

```
1 - pnorm(160,mean=100,sd=15) # Or just pnorm(160,100,15)
```

```
[1] 3.167124e-05
```

```
> options(scipen=999) # Supress scientific notation
> 1 - pnorm(160,mean=100,sd=15)
```

```
[1] 0.00003167124
```

Quantiles

```
> qnorm(0.975)

[1] 1.959964


> # An IQ of ___ is higher than 90% of the population,
> qnorm(0.90,100,15) # q for quantile

[1] 119.2233
```

χ^2 Distribution

```
> n = 50; xbar = 1.56
> Gsq = 2*n*(xbar*log(xbar) - (1+xbar)*(log(1+xbar)-log(2))); Gsq

[1] 6.174808


> 1-pchisq(Gsq,df=1) # p-value

[1] 0.0129582


> qchisq(0.95,1) # Critical value at alpha = 0.05

[1] 3.841459
```

t distribution

```
> 2*(1 - pt(2.14,df=10) ) # Two-tailed p-value

[1] 0.05803497


> qt(0.975,df=10) # Critical value

[1] 2.228139
```

F Distribution

```
> 1 - pf(3.17,6,114)

[1] 0.006504761


> qf(0.95,6,114) # Not in the table

[1] 2.1791
```

Gamma with α =shape, λ =rate

```
> pgamma(1,shape=21,rate=23.35) # P(Lambda < 1 |x)

[1] 0.7146466
```

Beta Distribution

For the coffee taste test, 60/100 consumers chose the new blend of coffee beans, yielding $\alpha' = \alpha + \sum_{i=1}^{n} x_i = 61$ and $\beta' = \beta + n - \sum_{i=1}^{n} x_i = 41$.

```
> pbeta(1/2,61,41)
```

```
[1] 0.02302203
```

Binomial Distribution

```
> # 20-question abcd multiple choice, probability of passing
> 1 - pbinom(9,20,0.25)

[1] 0.01386442
```

```
> # Probability of exactly 50 heads in 100 tosses of a fair coin
> dbinom(50,100,0.5)

[1] 0.07958924
```

Poisson Distribution

If there are really only a population mean of 8 rat hairs in a peanut butter jar, what is the probability of obtaining a sample mean of 9.2 (or more) from a random sample of 30 jars?
Distribution of $S = \sum_{i=1}^{n} X_i$ is Poisson$(30 * 8)$.

```
> 9.2*30

[1] 276

> 1 - ppois(275,240) # P(S geq 276)

[1] 0.01226396
```

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