June 15th, 2021 **Name** _____

SWMS- Lecture and Worksheet I in Probability and Statistics

In `Rstudio Cloud` open your project, and create a new file. Call it `Stat1.R`.

I have nominated one person in each group to share their screen while doing this first question. Nominated person: Please share your screen to the Rstudio Cloud screen.

After the end of every question, please redo Question 1, to see who will share their screen for the next question. (If the person chosen does not have a laptop or has already shared their screen, rerun code for Q1).

1. *(Drawing chits without wasting paper).* Let

$$x = \text{Number of people in your breakout group.}$$

Assign every student in your group a number between 1 to x.

Using `R`, roll an x-sided die to decide who will share their screen while writing the code for the rest of the problems.

2. Copy the following code in `R`.

```
p <- runif(1) # One random number between (0,1).
```

Consider `p` drawn above to be such that

$$\texttt{p} = \Pr(\text{Heads})\,.$$

Don't look at p!!

(a) Simulate coin tosses in `R` with the above probability of success.

(b) Without looking at `p`, can you guess what `p` is based on the simulated tosses above?

3. Suppose A is an event such that

$$\Pr(A) = p\,.$$

In the above question, you generated events A of probability p; $A =$ Obtaining Heads in a p-coin.

(a) Without calculating p^2, can you generate events of probability p^2. That is, find and generate an event B so that

$$\Pr(B) = p^2\,.$$

(b) Repeat the above to find an event C so that

$$C = p(1-p)\,.$$

4. *R practice: Stirling's Formula.*

Stirling's Theorem says that

$$\lim_{n\to\infty} \frac{n!}{(n^n/e^n)\sqrt{2\pi n}} = 1\,.$$

We would like to "verify" this result on the computer by looking at what happens as n increases. Look through the code below and fill in the correct formula for ...

```
max.n <- 100

# create an emptry vector of length max.n
stirling <- numeric(length = max.n)

# Find the ratio for each n = 1 through max.n
for(n in 1:max.n)
{
  # store stirling's ratio here
  stirling[n] <- ...
}

# Plot 1:max.n on the x axis, and the ratio on the y axies
plot(1:max.n, stirling)
```

(a) What do you see after the `plot()` command?

(b) Is the above process random or deterministic?