June 15th, 2021 **Name** _____

SWMS- Worksheet 2 in Probability and Statistics

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1. For the experiment of drawing numbers uniformly between $(45, 95)$.

   (a) What is the probability that you obtain the number 50?

   (b) What is the probability you obtain a number between $(50, 70)$?

   (c) What is the probability you obtain a number between $(50, 52)$?

2. Using `R`, "verify" your answer to each of the three questions. Choose whatever n you need to choose and increase the n if you feel it's necessary.

3. Using `R` and crude Riemann integration, obtain an approximation of the integral:

$$\int_0^1 \sin(50x) \log(x^2 + 10) dx \, .$$

After-class and a little hard

1. Can you think of exactly how the computer is truly giving completely uniform draws between $(0, 1)$? Consider the following:

   (a) Choose a constant x_0 (any number you want), and large positive numbers a and m

   (b) In a loop, calculate $x_n = ax_{n1} \mod m$ for $n = 1000$.

   (c) Store the sequence x_i/m for all $i = 1, \ldots, m$.

   Can you explain what is happening here? Below is the code that implements this and shows some plots. Change a a m and try and explain what is happening in the above steps.

```
m <- 2^(31) - 1
a <- 7^5
x <- numeric(length = 1e3)

x[1] <- 7 # indexing starts from 1
for(i in 2:(1e3+1))
{
  x[i] <- (a * x[i-1]) %% m
}

# For side-by-side plot
par(mfrow = c(1,2))
hist(x/m) # looks close to uniformly distributed
```