STA237 - Tutorial #5

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First, we want to show that the sums of independent normal random variables are normal. We have $X_1 \sim N(1,4), i = 1 \cdots, n$, and $\sum_1^n X_i$.

```
mu1 = 1 # mean
sigma1 = sqrt(4) # standard deviation
N = 40000 # number of simulations
n = 30 # sample size
```

```
sum_result = rep(0,N) # saves the sum of the generated sample with size n
for (i in 1:N) {
  one_sim = rnorm(n, mu1, sigma1)
  sum_result[i] = sum(one_sim)
}
```

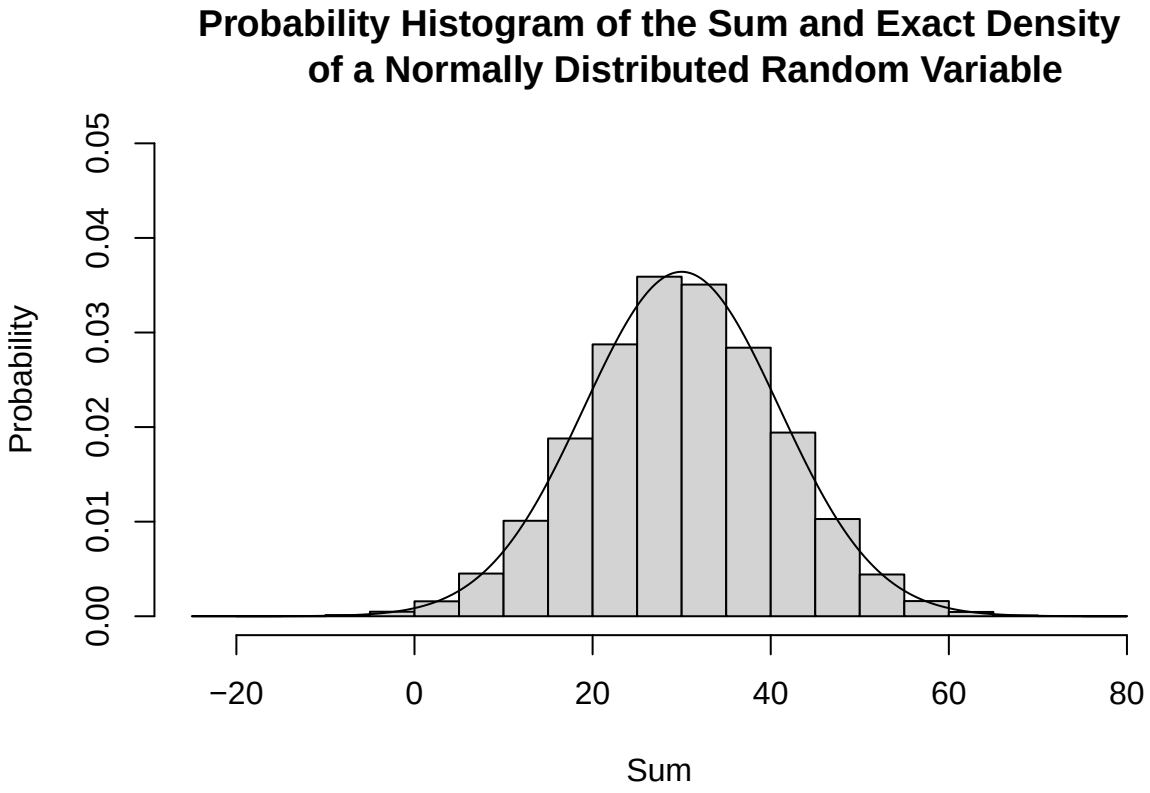
Next, we can calculate the exact density function of a normally distributed random variable. We have: $Y \sim N(30, 120)$.

```
mu2 = 30
sigma2 = sqrt(120)
range = 50
```

```
y = seq(mu2 - range, mu2 + range, by=0.1)
density = dnorm(y, mean=mu2, sd=sigma2)
```

Then, we can plot the probability histogram:

```
hist(sum_result, prob=TRUE,
     main = "Probability Histogram of the Sum and Exact Density
     of a Normally Distributed Random Variable",
     xlab = "Sum", ylab = "Probability", ylim=(c(0, 0.05)))
lines(y, density)
```


Probability Histogram of the Sum and Exact Density
of a Normally Distributed Random Variable
Probability
0.00
0.01
0.02
0.03
0.04
0.05
−20
0
20
40
60
80
Sum