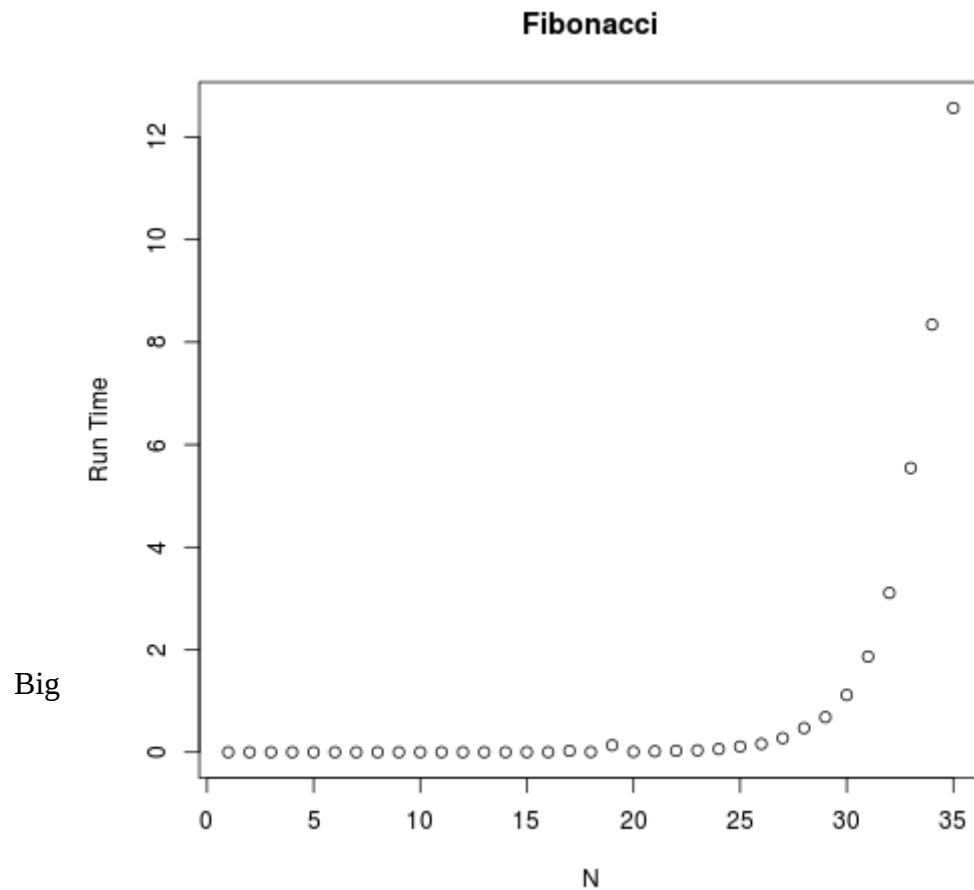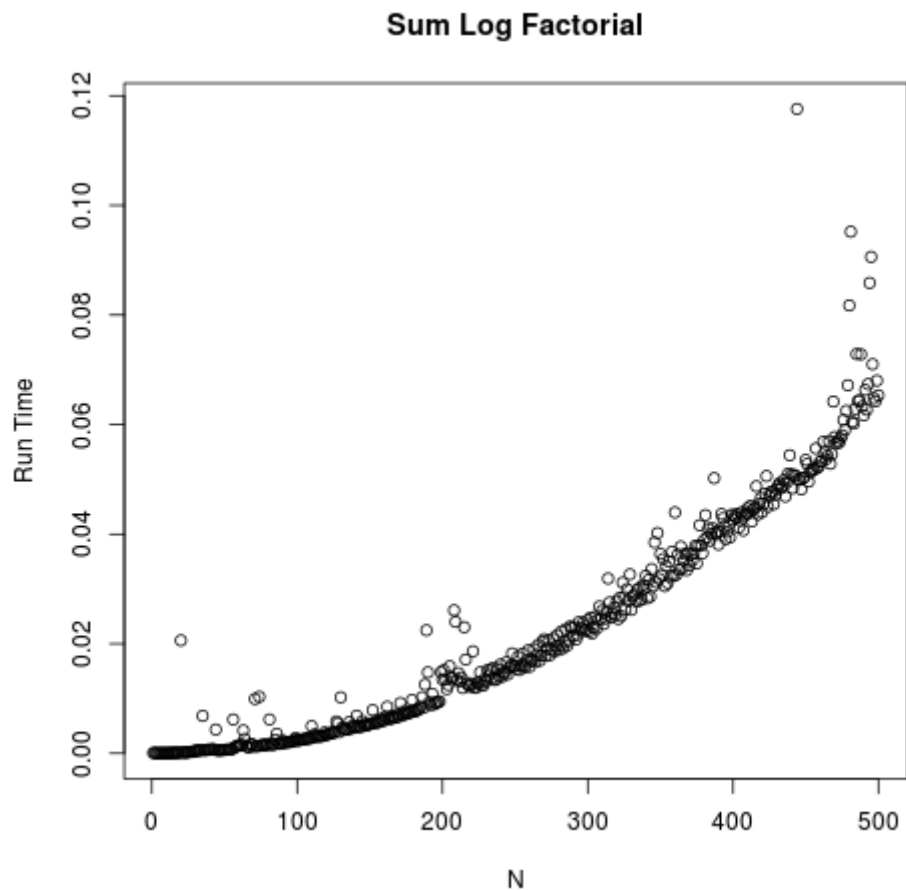Username: langelucci6

Note: runtime is in seconds.

Big O notation: O(2^N)

Fibonacci

Big

```
fibTimeVector = sapply(n, function(v) {

  start = Sys.time()
  fibonacci(v)
  end = Sys.time()
  return (end-start)
})

png("fibonacci.png",480,480,"px",12)
plot(n, fibTimeVector, main="Fibonacci", ylab="Run Time", xlab="N")
dev.off()
```

O notation: O(n log n)

Sum Log Factorial


```
sumLogTimeVector = sapply(n, function(v) {

  start = Sys.time()
  sum_log_factorial(v)
  end = Sys.time()
  return (end-start)
})

png("SumLogFactorial.png",480,480,"px",12)
plot(n, sumLogTimeVector, main="Sum Log Factorial", ylab="Run Time", xlab="N")
dev.off()
```

Big O notation: O (log n)
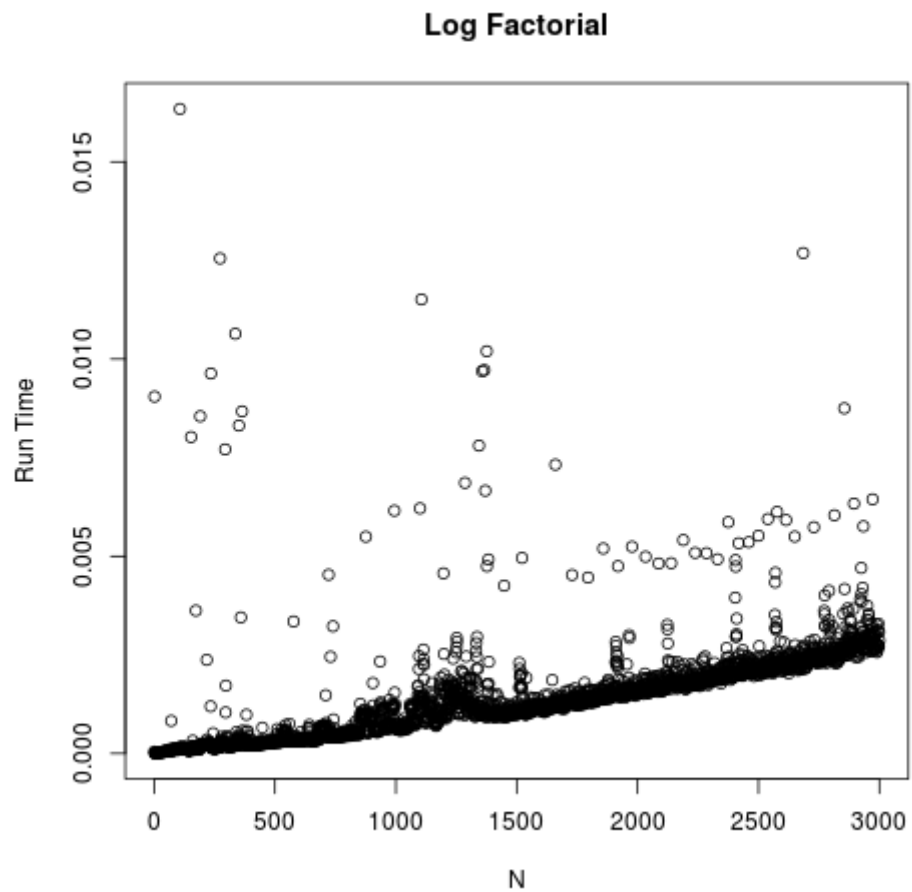
Log Factorial


```
logTimeVector = sapply(n, function(v) {

  start = Sys.time()
  log_factorial(v)
  end = Sys.time()
  return (end-start)
})

png("LogFactorial.png",480,480,"px",12)
plot(n, logTimeVector, main="Log Factorial", ylab="Run Time", xlab="N")
dev.off()
```