Continuous Variables, pt 3

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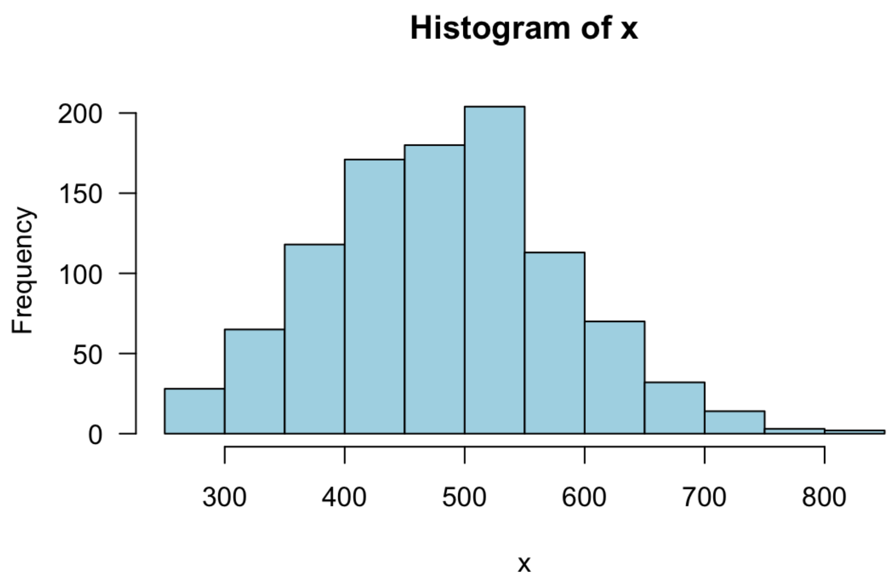
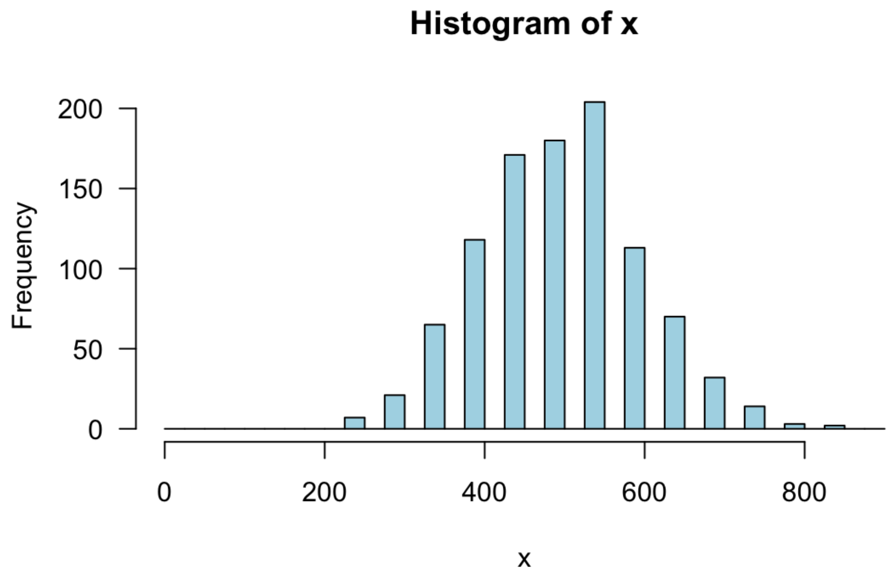
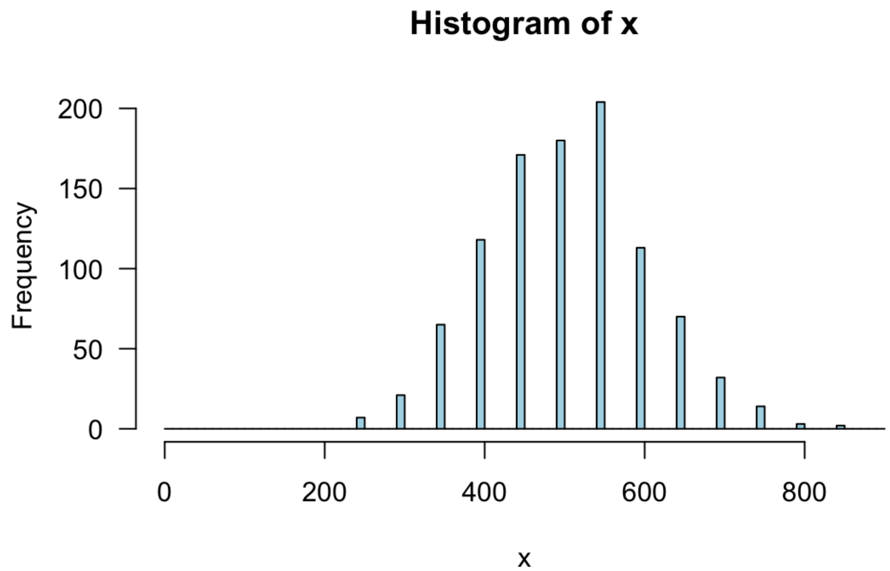
Rounding pattern



Change binwidth to 25



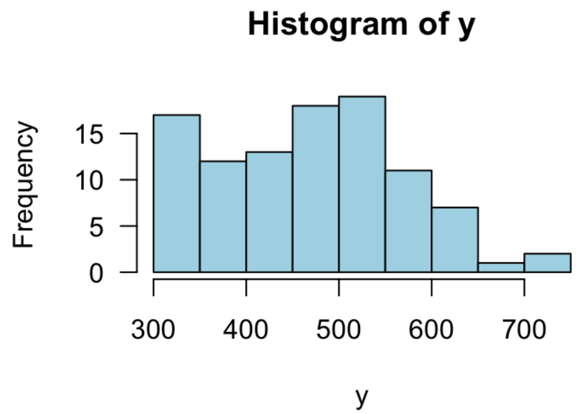
Change binwidth to 10



Stem and leaf

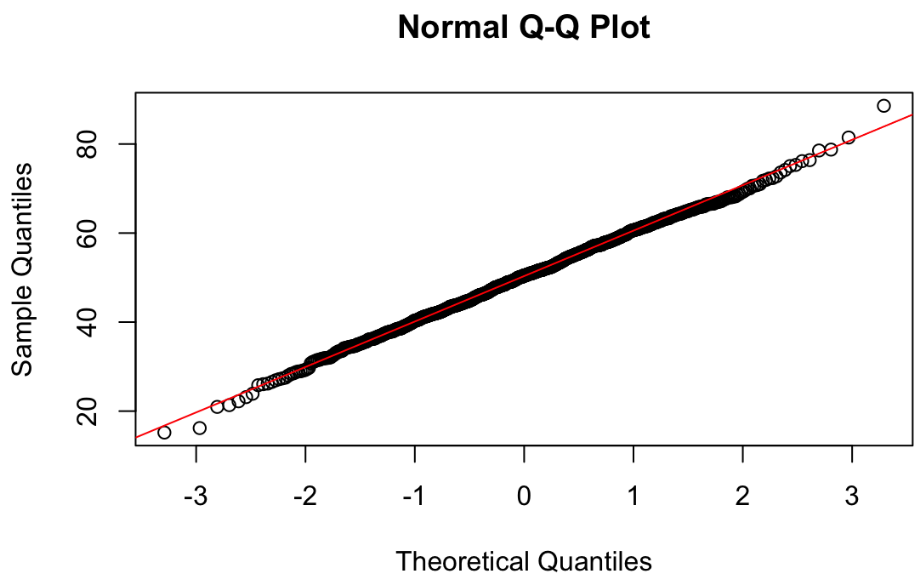
```r
stem(y)
```

```
##
##   The decimal point is 2 digit(s) to the right of the |
##
##   3 | 000
##   3 | 55555555555555
##   4 | 000000000000
##   4 | 5555555555555
##   5 | 000000000000000000
##   5 | 5555555555555555555
##   6 | 00000000000
##   6 | 5555555
##   7 | 0
##   7 | 55
```



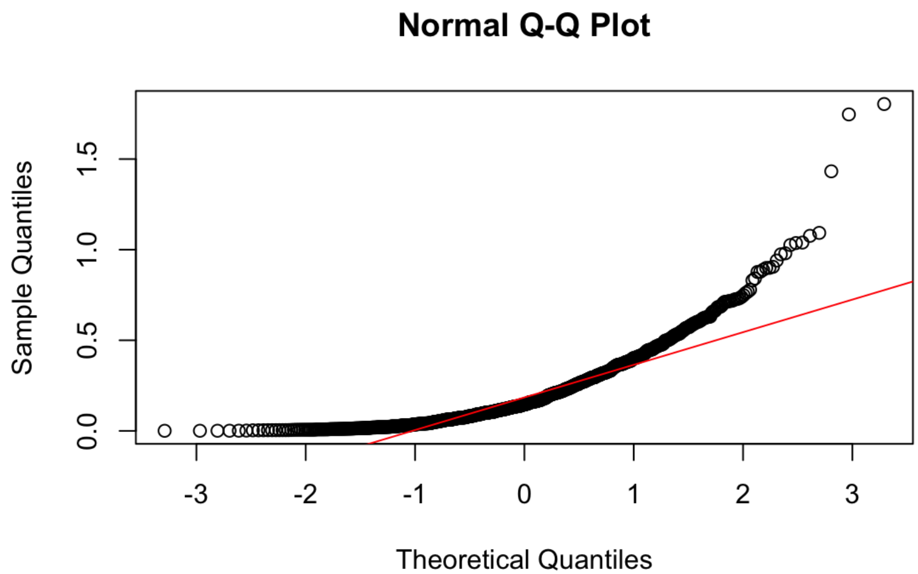
Q-Q plot (quantile-quantile)

normal



Q-Q plot (quantile-quantile)

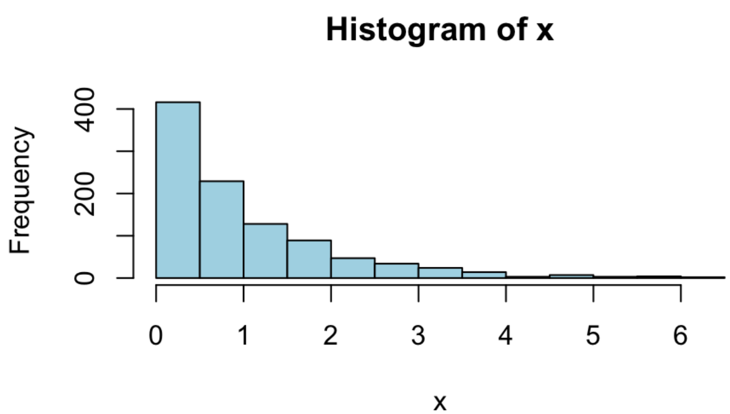
not normal



Exponential distribution

$$f(x) = \lambda e^{-\lambda x}$$

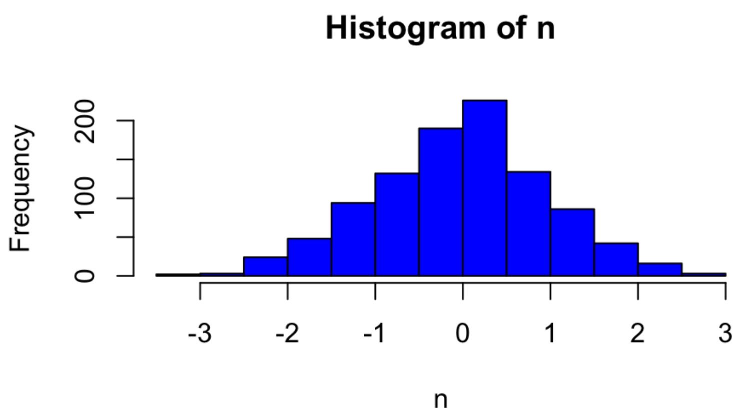
```r
set.seed(5702)
x <- rexp(1000, rate = 1)    # lambda
hist(x, col = "lightblue")
```



Normal distribution

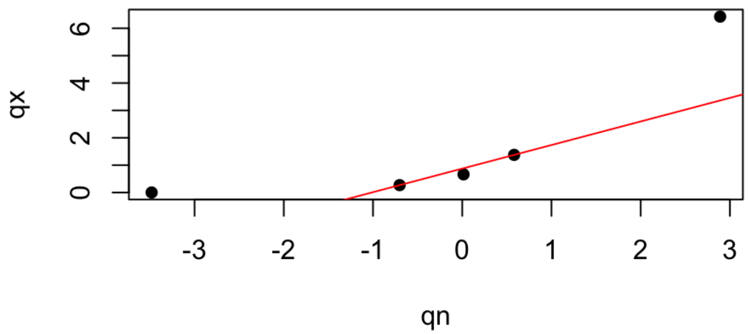
```r
n <- rnorm(1000)

hist(n, col = "blue")
```



DIY QQ plot

```
qx <- quantile(x)
qn <- quantile(n)
plot(qn, qx, pch = 16)
mod <- lm(c(qx[2], qx[4])~c(qn[2], qn[4]))
abline(mod, col = "red")
```




```
qx
```

```
##        0%      25%      50%      75%     100%
## 0.000645 0.269198 0.662714 1.375072 6.426470
```

```
qn
```

```
##       0%     25%     50%     75%    100%
## -3.4811 -0.7018  0.0145  0.5814  2.8903
```

DIY QQ plot

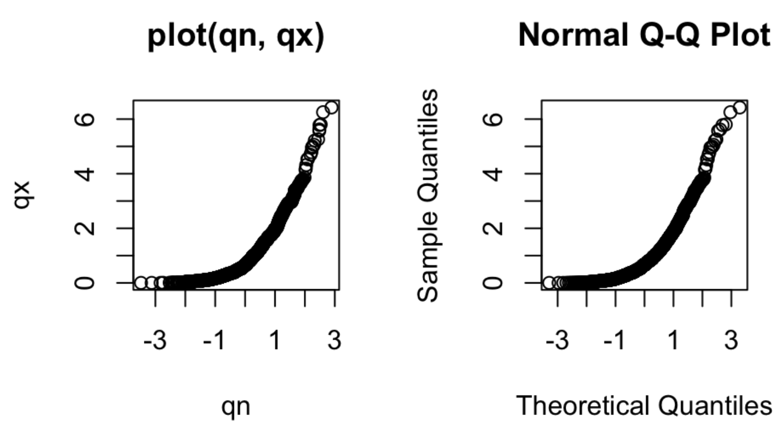
```
qx <- quantile(x, probs = seq(0, 1, .001))
qn <- quantile(n, probs = seq(0, 1, .001))
tail(qn)
```

```
##   99.5%   99.6%   99.7%   99.8%   99.9% 100.0%
##    2.48    2.48    2.49    2.53    2.61    2.89
```

```
tail(qx)
```

```
##   99.5%   99.6%   99.7%   99.8%   99.9% 100.0%
##    5.57    5.62    5.78    5.80    6.25    6.43
```

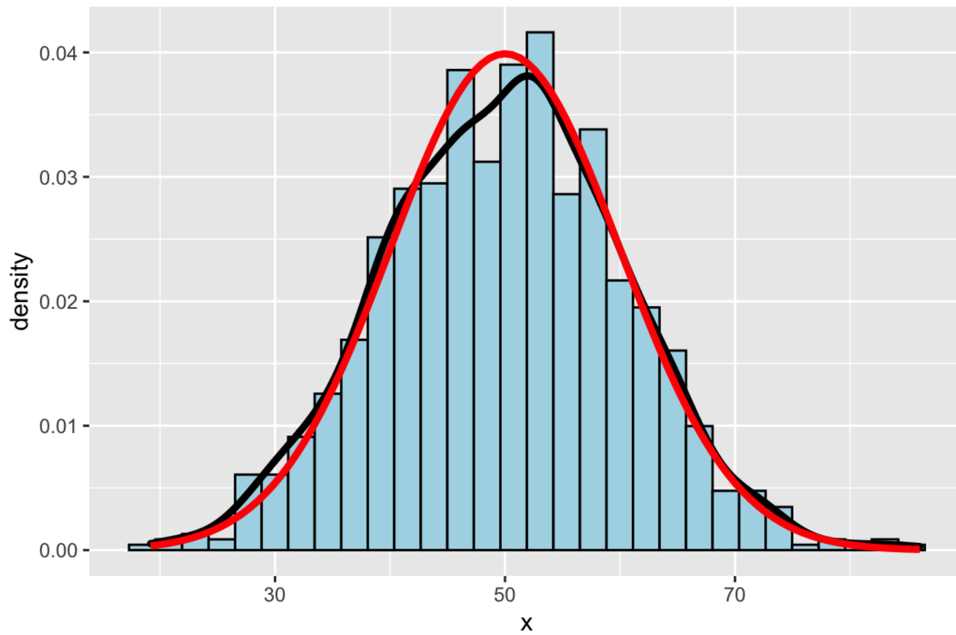
```
oldpar <- par(mfrow = c(1, 2))
plot(qn, qx, main = "plot(qn, qx)")
qqnorm(x)
```




```
par(oldpar)
```

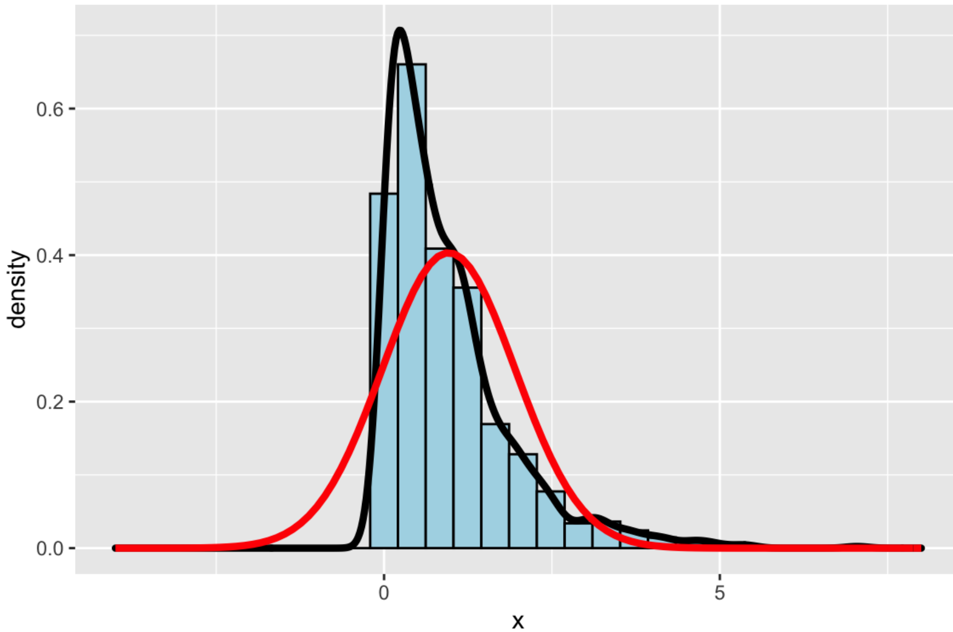
Density Curve + Normal Curve

Normal



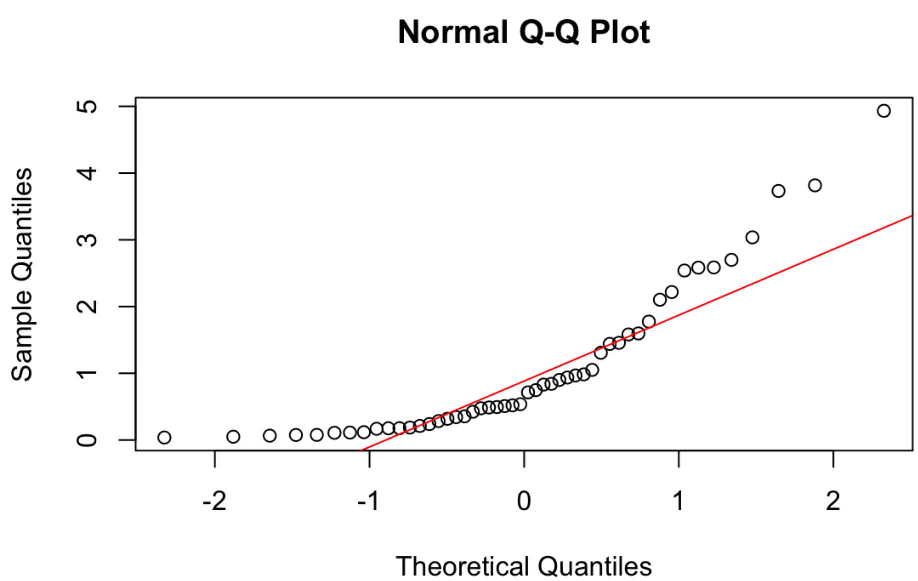
Density Curve + Normal Curve

Not normal



Shapiro Wilk test

```
x <- rexp(50)
qqnorm(x)
qqline(x, col = "red")
```



Null hypothesis: data is normally distributed

Alternative hypothesis: data is not normally distributed

Can we reject the null hypothesis?

```
shapiro.test(x)
```

```
##
##   Shapiro-Wilk normality test
##
## data:  x
## W = 0.8, p-value = 0.000003
```

W is the test statistic

p-value depends on W and n