Regression-Simulation

Parin Shah

November 30, 2015

Part 1

Question 1

We begin by sampling from a normal distribution and transforming it to a variable called `y1`.

```
# Random draws from a normal distribution
norm1 <- rnorm(1000, 6, 10)
# Constant
a <- 4
# Transformation
y1 <- a - norm1
```

1. True mean of `norm1` is 6, true standard dev is 10 and the true variance is 100.
2. Approximated mean of `norm1` calculated using `mean(norm1)` equals

```
## [1] 6.12411
```

Approximated standard dev of `norm1` calculated using `sd(norm1)` equals

```
## [1] 10.07359
```

Approximated variance of `norm1` calculated using `var(norm1)` equals

```
## [1] 101.4773
```

3. `a` is a constant with a value of 4.
4. Mean of `y1` $= 4 - \mu_{norm1}$ = -2.191046, Variance of `y1` is $0 + s^2_{norm1}$ = 98.5769 and the standard dev of `y1` is $\sqrt{98.5769}$
5. Approximated mean of `y1` calculated using `mean(y1)` equals

```
## [1] -2.12411
```

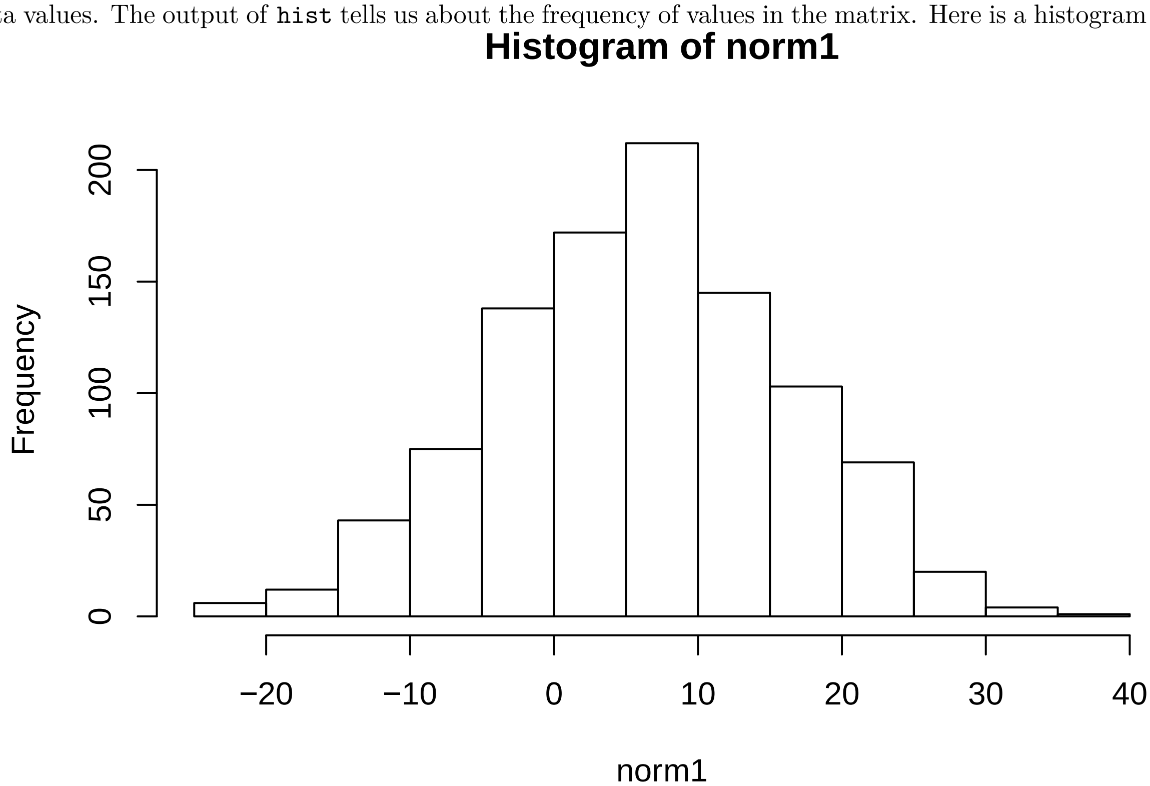
Approximated standard dev of `y1` calculated using `sd(y1)` equals

```
## [1] 10.07359
```

Approximated variance of `y1` calculated using `var(y1)` equals

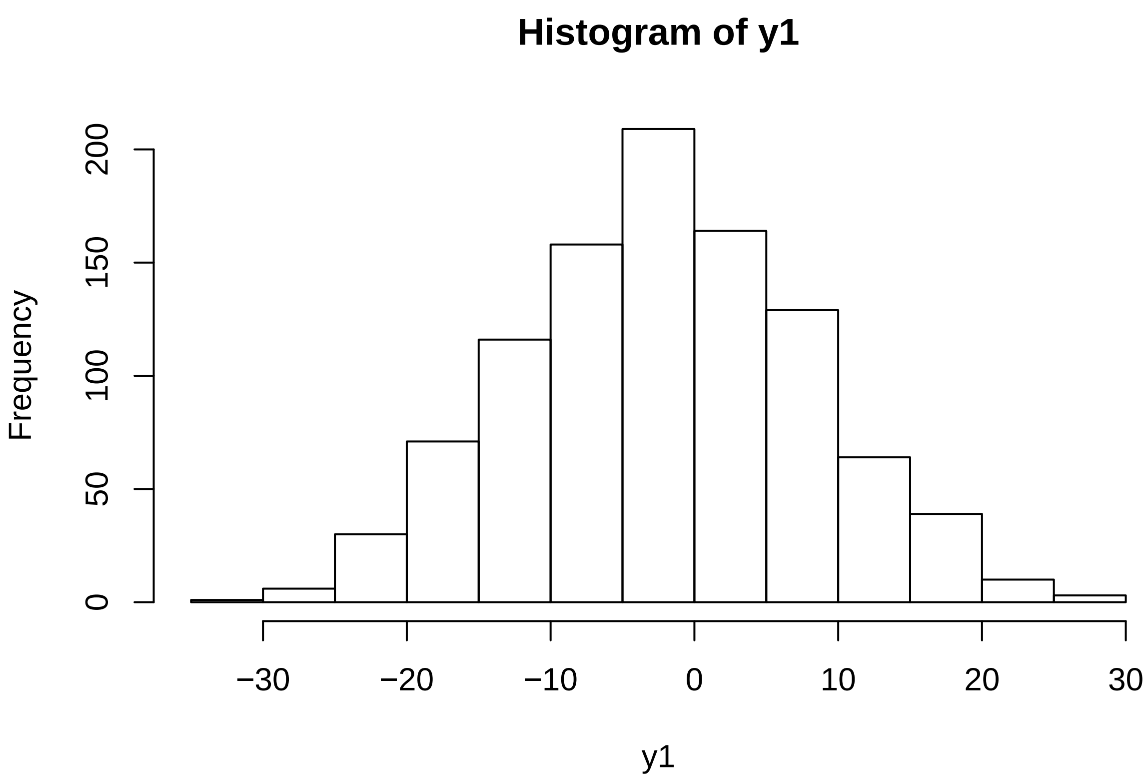
```
## [1] 101.4773
```

Yes, the calculations concide with my expectations in 4. 6. The function `hist` computes a histogram of the given data values. The output of `hist` tells us about the frequency of values in the matrix. Here is a histogram



of `norm1`

Here is a histogram of `y1`



7. We used 1000 samples. If we used 100 samples instead, it would less approximate a normal distribution.

8. We regress `y1` on `norm1`.

```
##
## Call:
## lm(formula = y1 ~ norm1)
##
## Coefficients:
## (Intercept)        norm1
##           4           -1
```

Question 2

We begin by sampling from a normal distribution and transforming it to a variable called `y2`.

```
# Sample distribution 2
norm2 <- rnorm(10000, 0, 4)
b <- 3

y2 <- b*norm2
```

1. True mean of `norm2` is 0, true standard dev is 4 and the true variance is 16.
2. Approximated mean of `norm2` calculated using `mean(norm2)` equals

```
## [1] 0.01105501
```

Approximated standard dev of `norm2` calculated using `sd(norm2)` equals

```
## [1] 4.005438
```

Approximated variance of `norm2` calculated using `var(norm2)` equals

```
## [1] 16.04354
```

3. `b` is a constant with a value of 3.
4. Mean of `y2` $= 3 * \mu_{norm2}$, Variance of `y2` is $9 * s^2_{norm2}$ and the standard dev of `y2` is $\sqrt{s^2}$
5. Approximated mean of `y2` calculated using `mean(y2)` equals

```
## [1] 0.03316503
```

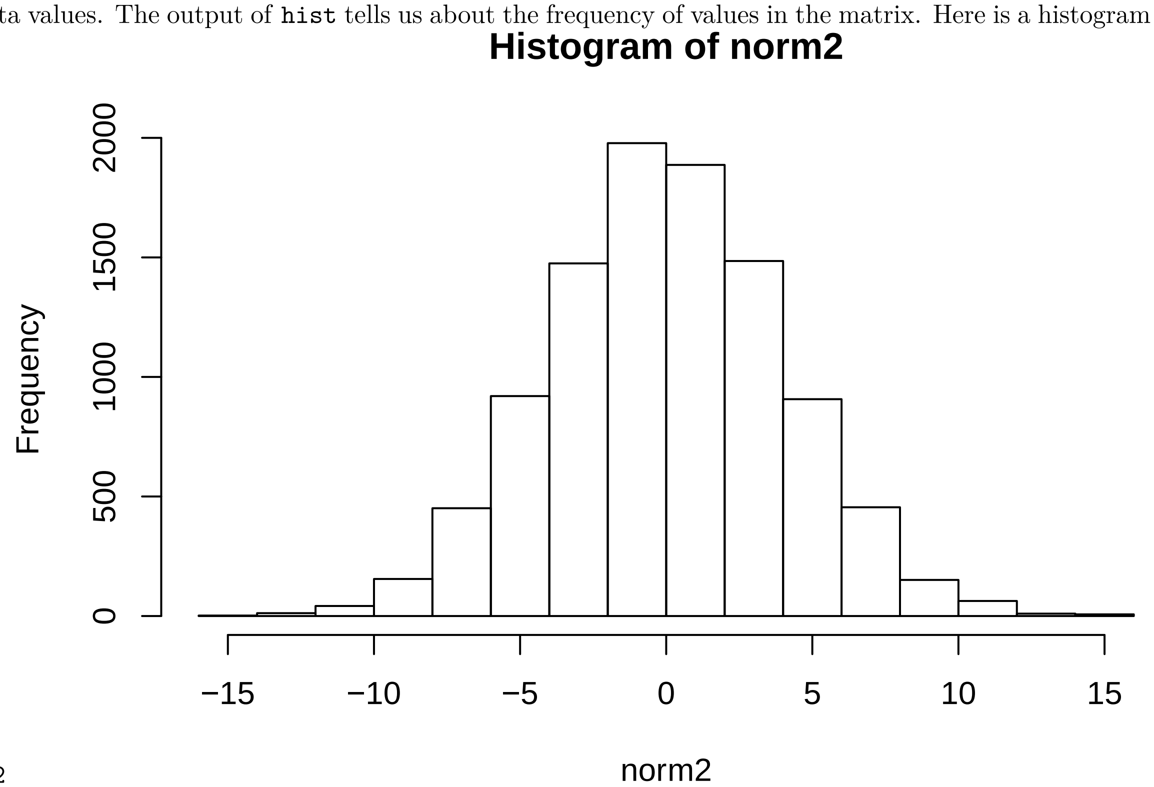
Approximated standard dev of `y2` calculated using `sd(y2)` equals

```
## [1] 12.01631
```

Approximated variance of `y2` calculated using `var(y2)` equals

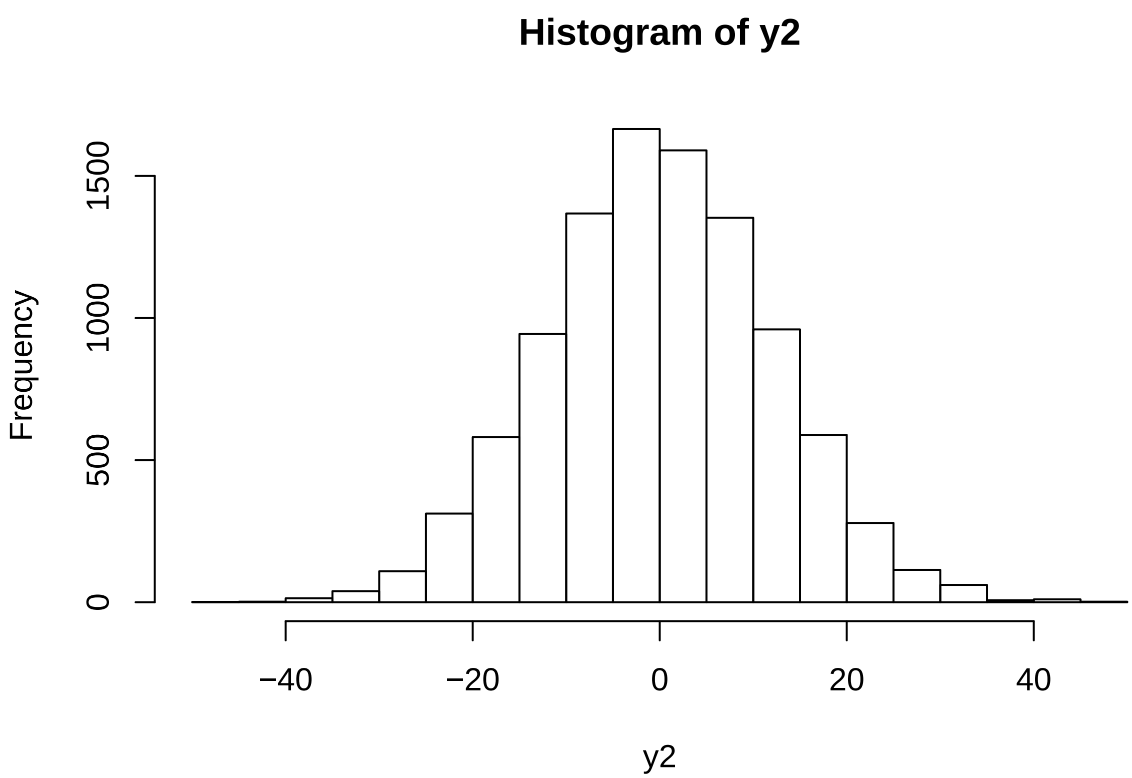
```
## [1] 144.3918
```

Yes, the calculations concide with my expectations in 4. 6. The function `hist` computes a histogram of the given data values. The output of `hist` tells us about the frequency of values in the matrix. Here is a histogram



of `norm2`

Here is a histogram of `y2`



7. We used 1000 samples. If we used 100 samples instead, it would less approximate a normal distribution.

8. We regress `y2` on `norm2`.

```
##
## Call:
## lm(formula = y2 ~ norm2)
##
## Coefficients:
## (Intercept)        norm2
##   4.663e-16    3.000e+00
```

Question 3

We begin by sampling from a normal distribution and transforming it to a variable called `y3`.

```r
# Sample distribution 3
norm3  <- rnorm(1500, 0, 5)
a <- 4
b <- 3

y3 <- a + b*norm3
```

We regress `y3` on `norm3`.

```
##
## Call:
## lm(formula = y3 ~ norm3)
##
## Coefficients:
## (Intercept)        norm3
##           4            3
```

Part 2

```r
# Sample from 2 normal distributions
x1 <- rnorm(100)
x2 <- rnorm(100)

# Construct constants
beta0 <- 0
beta1 <- 2
beta2 <- 8

# Construct equation
z <- beta0 + beta1*x1 + beta2*x2 + rnorm(100)
```

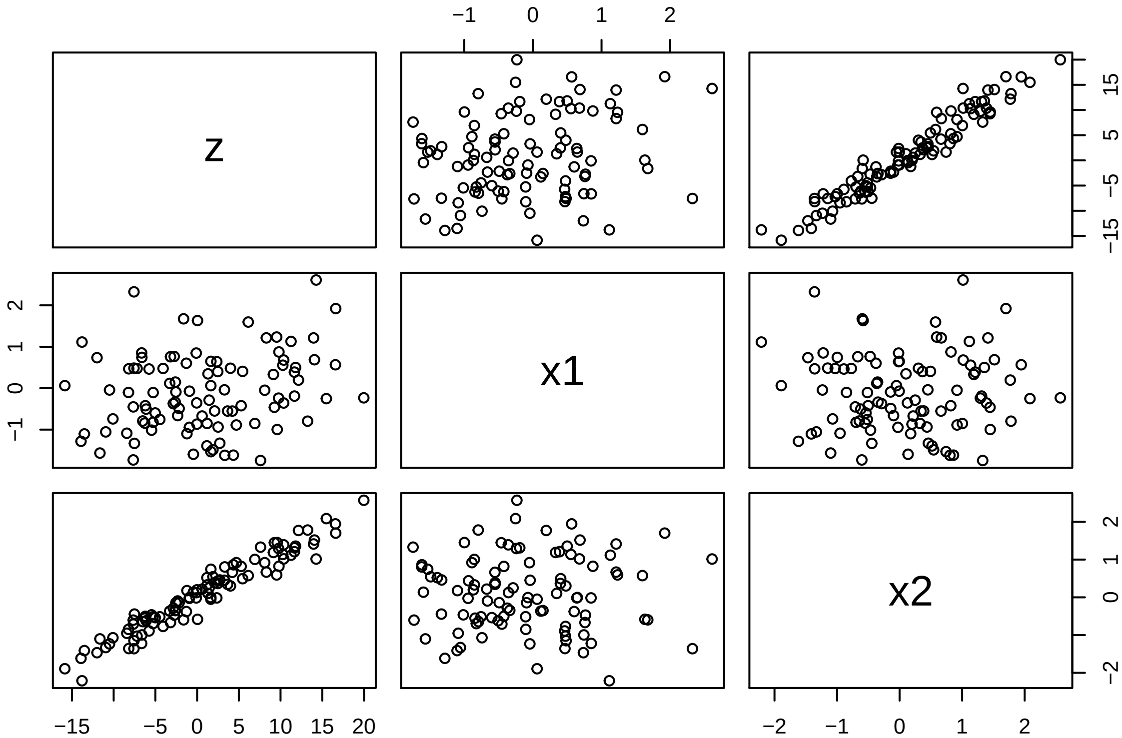
We regress using R's '`lm` function based on the above equation

```
##
## Call:
## lm(formula = z ~ x1 + x2 + rnorm(100))
```

```
##
## Coefficients:
## (Intercept)           x1           x2   rnorm(100)
##     0.18048      1.92046      7.89313      0.04007
```

```r
# Build a matrix from above
mat <- cbind(z, x1, x2)
```

```r
# Examine plots
pairs(mat)
```



Part 3