344HW2

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Problem 1 We want to estimate S = E[X^2] when X has a density proportional to q(x) = exp{-|x|^3/3}

q(x) looks somewhat like a normal distribution, so I will use that as my g(x). To envelope all of q(x), alpha must be set to at most 1/3 So, in this case, g(x) ~ N(0,1), alpha = 1/3, e(x) ~ 3*N(0,1), and U ~ U(0,1)

```
n <- 100000
u <- runif (n, 0, 1)
g <- rnorm (n)
```

q_x defines the function that we wish to sample from

```
q_x <- function (x) {
  new_x = exp(-(1/3)*abs(x)^3)
  return (new_x)
}
```

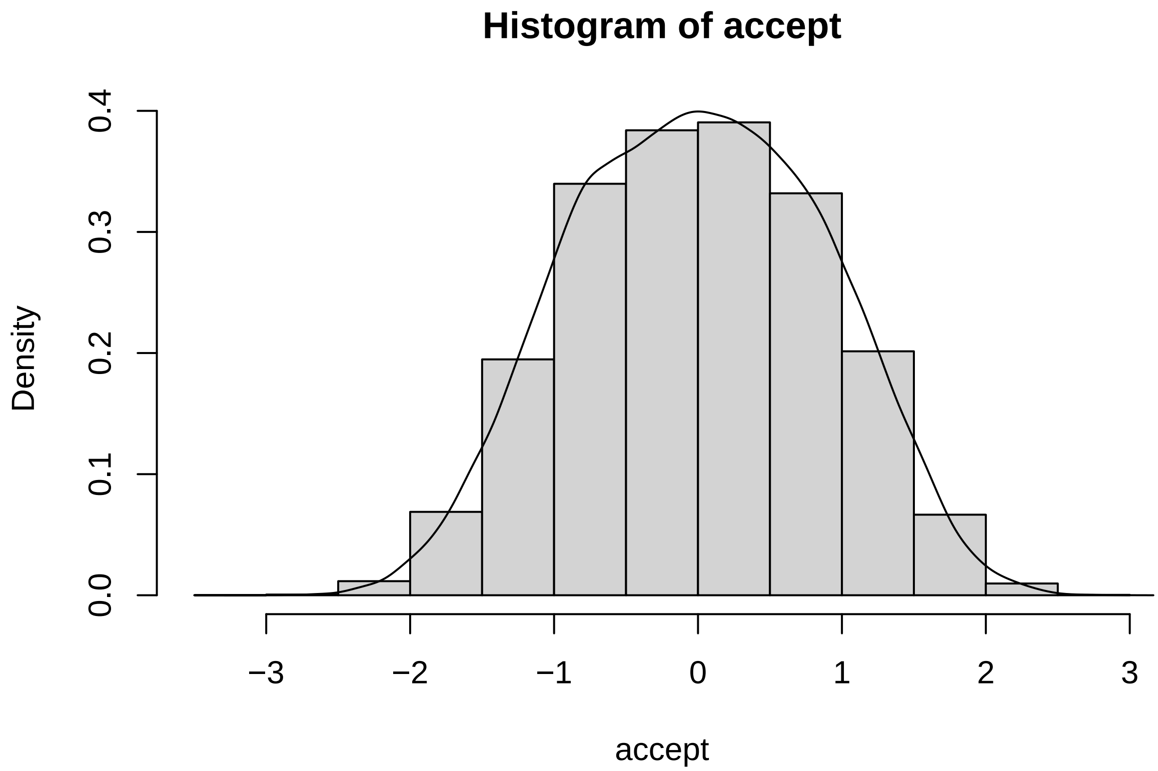
We now want to parse through every element we generated and test if the uniform value is less than or equal to q(x)/e(y), which in this case is 3*g(x). If this statement is true, we add it to the list of accepted values. If not, move on.

```
count <- 1
accept <- c()

while (count <= n) {
  u_sample = u[count]
  x_sample = q_x(g[count])/(3*dnorm (g[count]))
  if (u_sample <= x_sample) {
    accept = rbind (accept, g[count])
    count = count + 1
  }
  count = count + 1
}
```

Finally, draw a histogram and find the acceptance rate and E[X^2]

```
hist (accept, prob=T)
lines (density (accept))
```




```
acceptance_rate = length(accept)/n
acceptance_rate
```

```
## [1] 0.46125
```

```
mean (accept^2)
```

```
## [1] 0.7656828
```