w203_lab2_q4_SH

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4e

1. Create a function that draws n of X_i, Y_i, and D_i

```
set.seed(15) #set seed for reproducible results

f <- function(n) {

  X <- runif(n,-1,1)
  Y <- runif(n,-1,1)
  D = 0

  for (i in c(1:n)){
  D[i] = ifelse( (X[i])^2 + (Y[i])^2 < 1, 1, 0)
  }

  return(D)
}
```

2. Draw D_i's for 100 X_i and Y_i

```
D_100 = f(100)
```

3. Compute $\overline{D}$

```
#sample mean
mean(D_100)
```

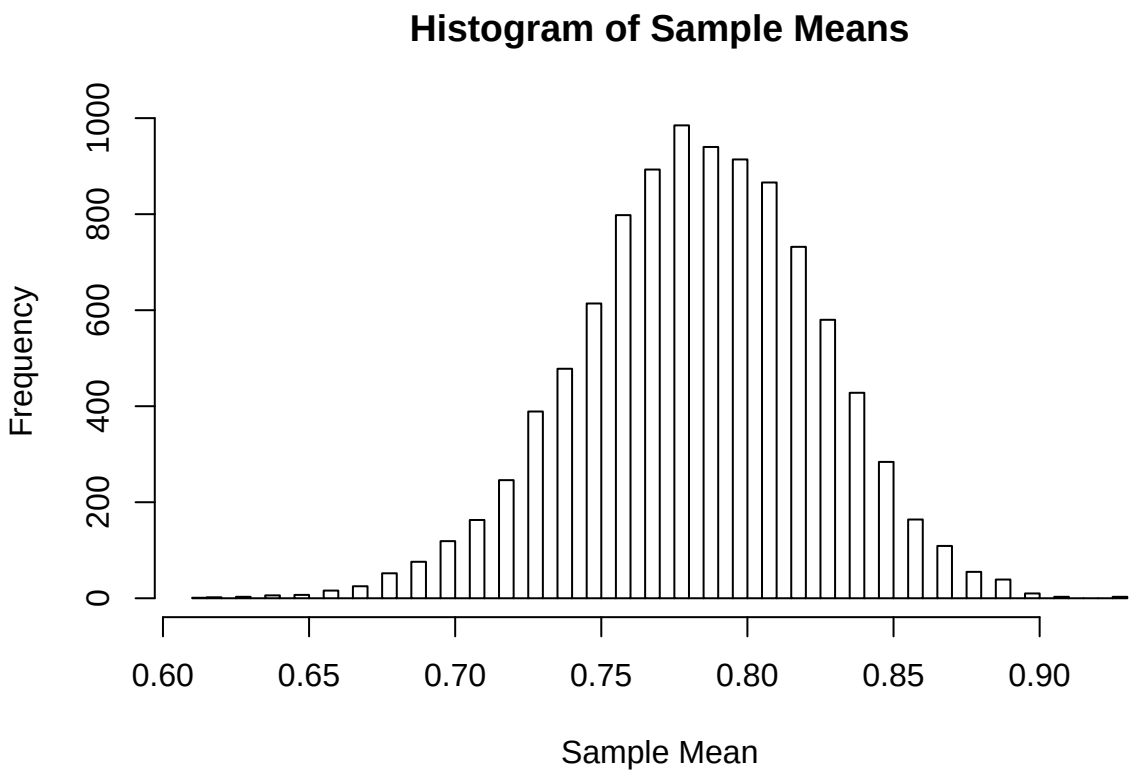
```
## [1] 0.78
```

The mean of Di's from a sample of 100 X_i's and Y_i's is 0.78, which is close to the $E(D_i)$, $\frac{\pi}{4}$ or 0.79 as calculated in part a.

4f

1. Replicate Experiments and Plot Sample Means

```
draws <- replicate(10000, mean(f(100)))
hist(draws, breaks = 50, xlab = "Sample Mean", main = "Histogram of Sample Means")
```



4g

Standard Deviation of Sample Means, or Standard Error of $\overline{D}$

```
sd(draws)
```

```
## [1] 0.04111142
```

With $n = 100$, from part c, we'd expect the standard error to be 0.041 which is very close to what we have here.

4h

Compute Fraction of $\overline{D}$ that are larger than $\frac{3}{4}$

```
sum(draws > 3/4)/10000
```

```
## [1] 0.7803
```

The value calculated from part d is 0.806, which is close to the simulated result