Stats for DS HW 8

Matthew DeSantis

2022-11-02

5.4.5

X is the height of randomly selected segment. X has mean 36 and variance 1/12. Because the number is large (>=30), we can say (by the central limit theorem) that the mean height of a tower (the sum of 30 segments) is approximately normally distributed ~N(30*36, 30*1/12). The difference of the two towers' heights would then be approximately N~(0, 5). The chance that this is less than 4 and greater than -4 would be as given in the R code. Because this is based on the CLT, this is an approximation.

```
pnorm(4,0,sqrt(5))-pnorm(-4,0,sqrt(5))
```

```
## [1] 0.9263617
```

Additional Problem 1

$Y = \ln(X) \rightarrow X = \exp(Y)$ for $\exp(Y) > 0$ (which is everywhere)
$fy(y) = \exp(y-\exp(y))$ for negative infinity $< y <$ positive infinity

Additional Problem 2

Inverses: X1=Y1/Y2, X2=Y2
Jacobian: (1/Y2)(1) + (-Y1/Y2^2)(0) = 1/Y1
Bounds: 0<Y1<Y2<1
fY1,Y2(y1,y2) = (Y1/Y2^2)+1 for 0<Y1<Y2<1

Additional Problem 3

(a)

```
set.seed(488103)
n = 100000
X1 = runif(n)
X2 = runif(n)
Y = c()
for(x in 1:n){
  Y = append(Y, max(X1[x], X2[x]))
}
CDF = function(x){
  length(Y[Y<=x])/n
}
CDF(0.5)
```

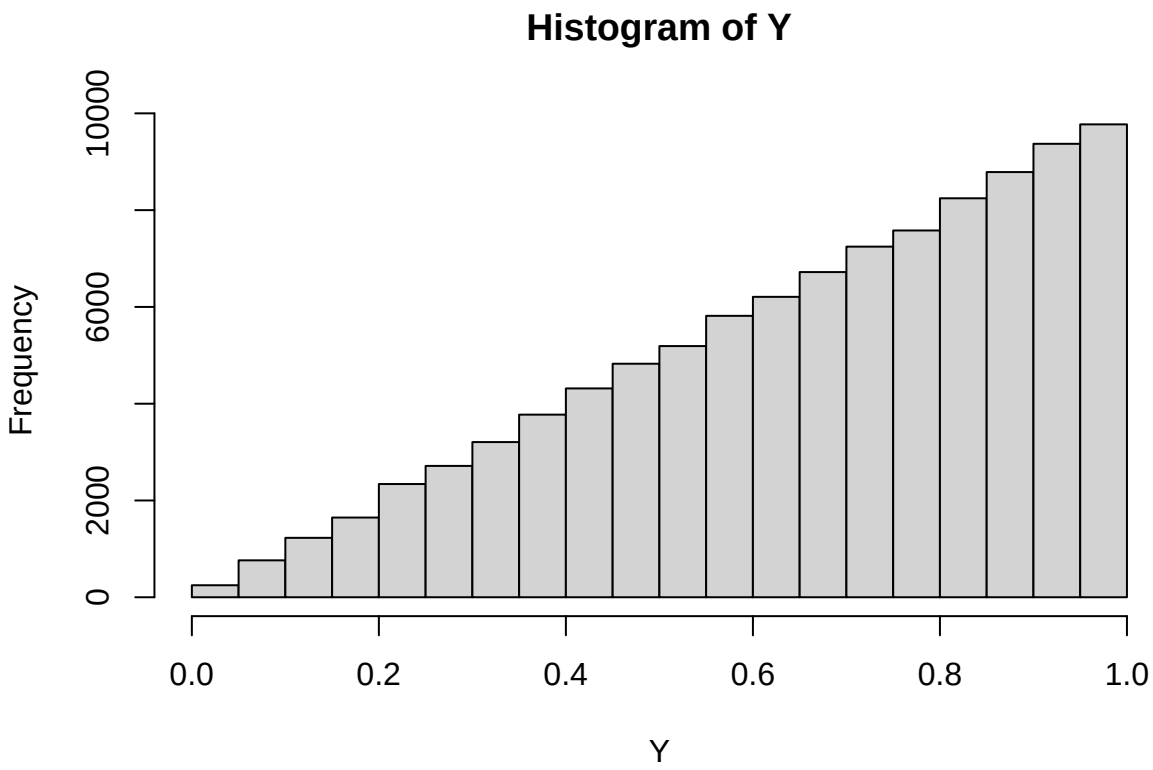
```
## [1] 0.25063
```

```
CDF(0.75)
```

```
## [1] 0.56244
```

(b)

```
hist(Y)
```


Histogram of Y
Frequency
0
2000
6000
10000
0.0
0.2
0.4
0.6
0.8
1.0
Y