HW5

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HW5

Choose independently two numbers B and C at random from the interval $[0, 1]$ with uniform density. Prove that B and C are proper probability distributions.Note that the point (B,C) is then chosen at random in the unit square.

Find the probability that

(a) B + C < 1/2.

(b) BC < 1/2.

(c) |B - C| < 1/2.

(d) max{B,C} < 1/2.

(e) min{B,C} < 1/2.

Q :- Prove that B and C are proper probability distributions

```r
# A probability distribution is a statistical function that describes all the possible values and likel

n <- 10000
B <- as.data.frame(runif(n, min=0, max=1))
C <- as.data.frame(runif(n, min=0, max=1))



min(B)
```
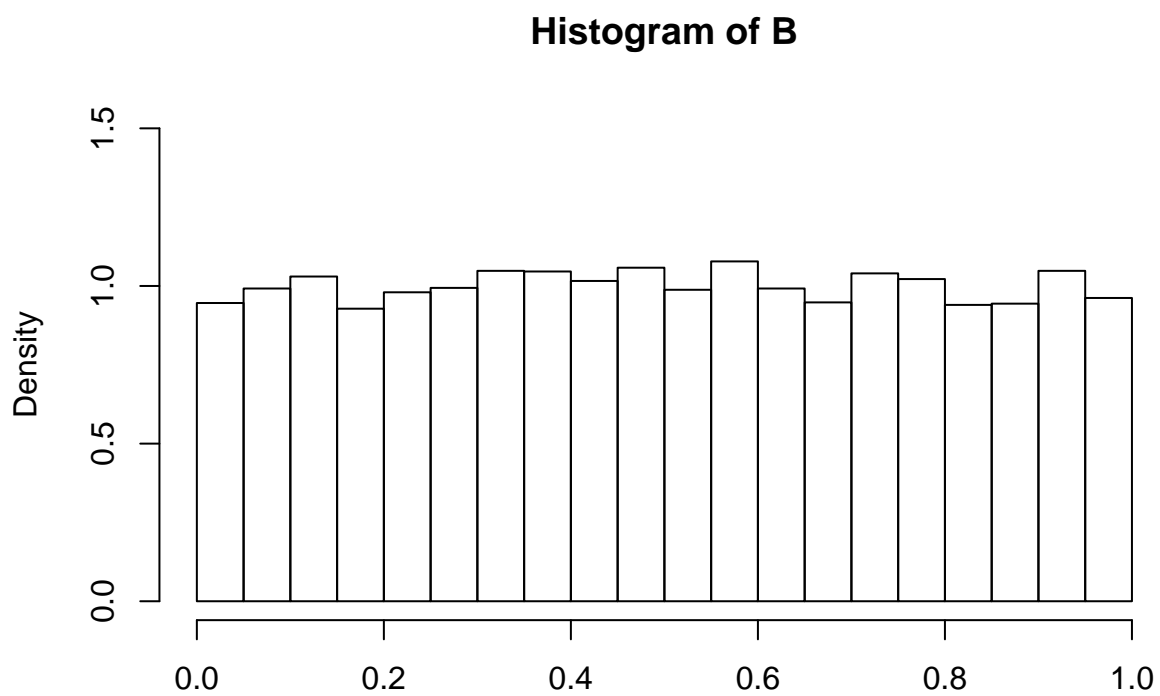
```
## [1] 2.069725e-05
```

```r
max(B)
```

```
## [1] 0.9997981
```

```r
# checking the skewness of B
hist(B[,1], prob=TRUE, ylim=c(0,1.5), main = 'Histogram of B', xlab = '')
```

Histogram of B

Density


```r
min(C)
```

```
## [1] 0.0002287303
```
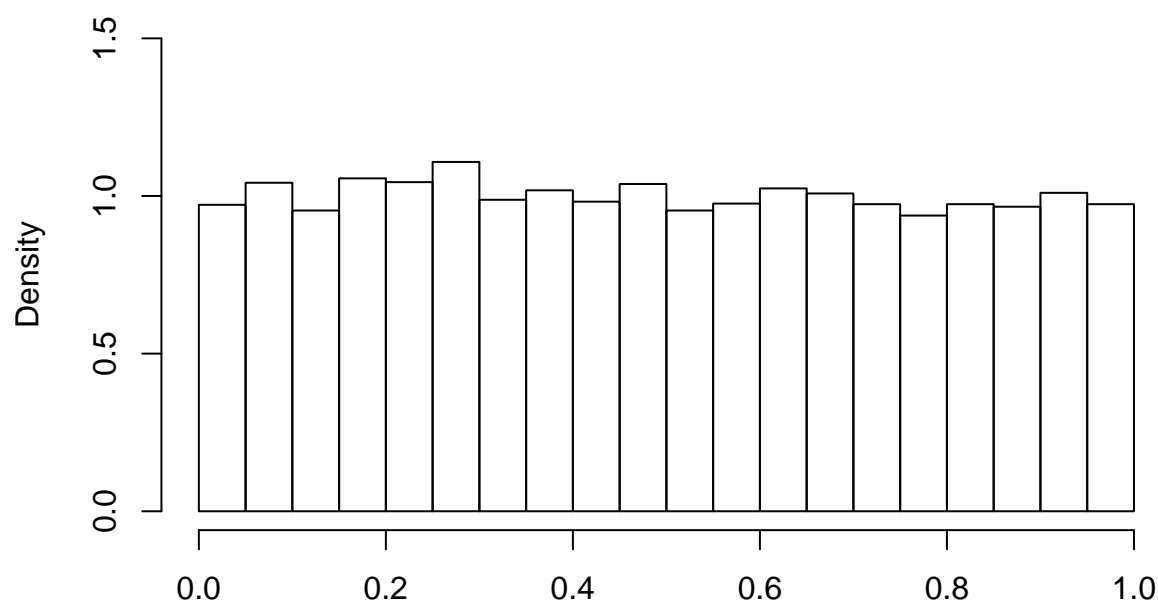
```r
max(C)
```

```
## [1] 0.9999059
```

```r
#checking skewness of C
hist(C[,1], prob=TRUE, ylim=c(0,1.5), main = 'Histogram of B', xlab = '')
```

Histogram of B


```
j = 0
for(i in 1:length(B)){
  if(B[i]+C[i] < 0.5){
    j = j+1
  }
}
```

```
## Warning in if (B[i] + C[i] < 0.5) {: the condition has length > 1 and only
## the first element will be used
```

```
print(paste("The Probabilty B+C < 1/2 =", j/length(B)))
```

```
## [1] "The Probabilty B+C < 1/2 = 0"
```

As we can see bins of both the histogram are evenly distributed, B & C is proper probability distributions.

(a)

```
a <- sum((B+C) < .5)/n
print(paste("The probability of B+C less than 1/2 is",a))
```

```
## [1] "The probability of B+C less than 1/2 is 0.125"
```

(b)

```
b <- (sum((B*C) < .5)/n)
print(paste("The probability of B*C less than 1/2 is",b))
```

```
## [1] "The probability of B*C less than 1/2 is 0.8495"
```

(c)

```
c <- sum(abs((B-C)) < .5)/n
print(paste("The probability of |B-C| be less than 1/2 is",c))
```

```
## [1] "The probability of |B-C| be less than 1/2 is 0.7543"
```

(d)

```
d <- 1
B <- runif(n, min=0, max=1)
C <- runif(n, min=0, max=1)
for(i in 1:length(B)){
  if(max(B[i], C[i]) < 0.5){
    d = d + 1
  }
}
d <- d/10000
print(paste("The probability of max{B,C} less than 1/2 is",d))
```

```
## [1] "The probability of max{B,C} less than 1/2 is 0.2484"
```

(e)

```
e <- 1
B <- runif(n, min=0, max=1)
C <- runif(n, min=0, max=1)
for(i in 1:length(B)){
  if(min(B[i], C[i]) < 0.5){
    e = e + 1
  }
}
e <- e/10000
print(paste("The probability of min{B,C} less than 1/2 is",d))
```

```
## [1] "The probability of min{B,C} less than 1/2 is 0.2484"
```