605 - HW 5

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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.

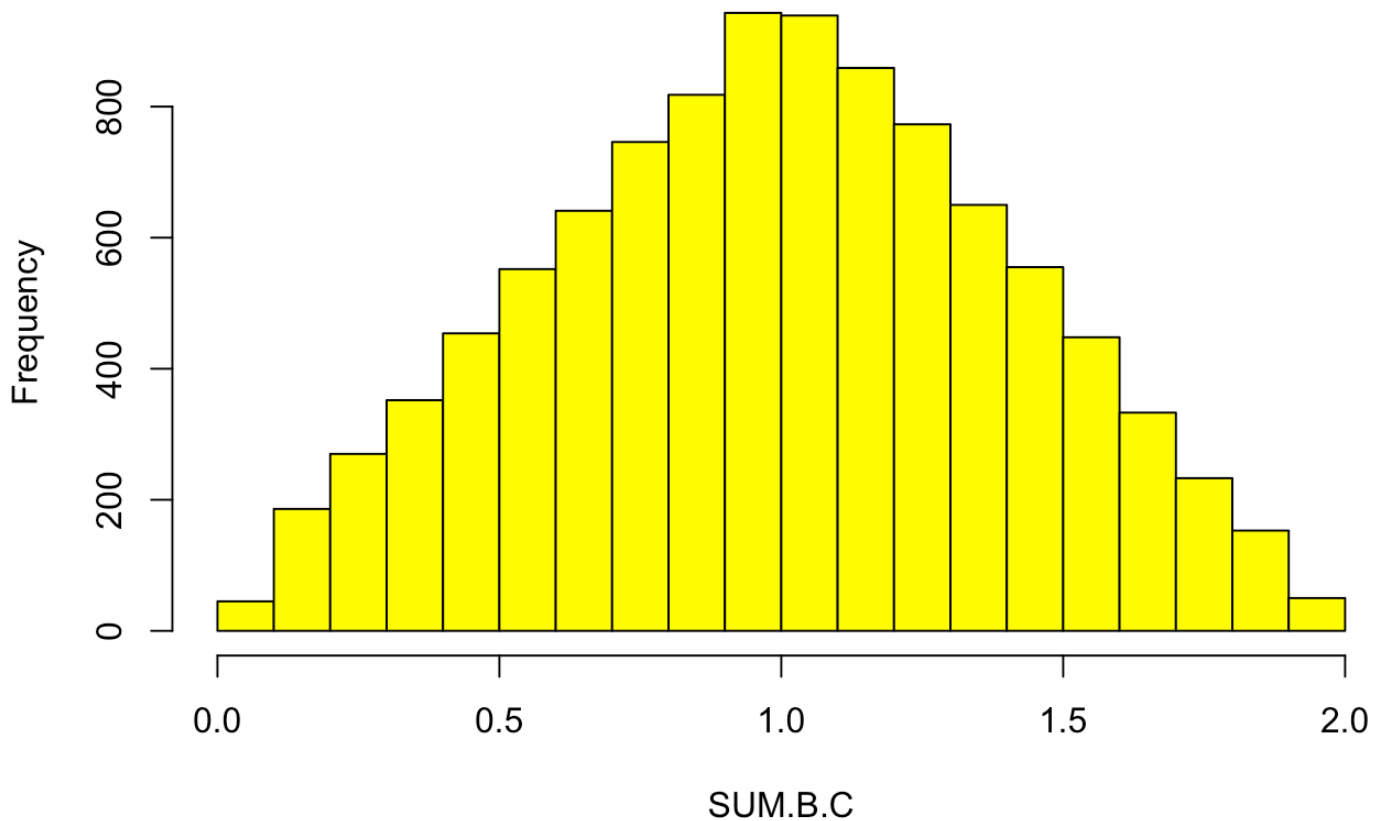Note that the point (B,C) is then chosen at random in the unit square.

Find the probability that:

```
B <- runif(10000, 0, 1)
C <- runif(10000, 0, 1)
#B;C
#hist(A); hist(B)
```

(a) B + C < 1/2.

```
#(B + C) < 1/2
SUM.B.C <- (B + C)
hist(SUM.B.C, main = "Histogram of Distribution of B + C", col = "ye
llow", breaks=20)
```

Histogram of Distribution of B + C


```
length(which(SUM.B.C < 1/2))/length(SUM.B.C)
```
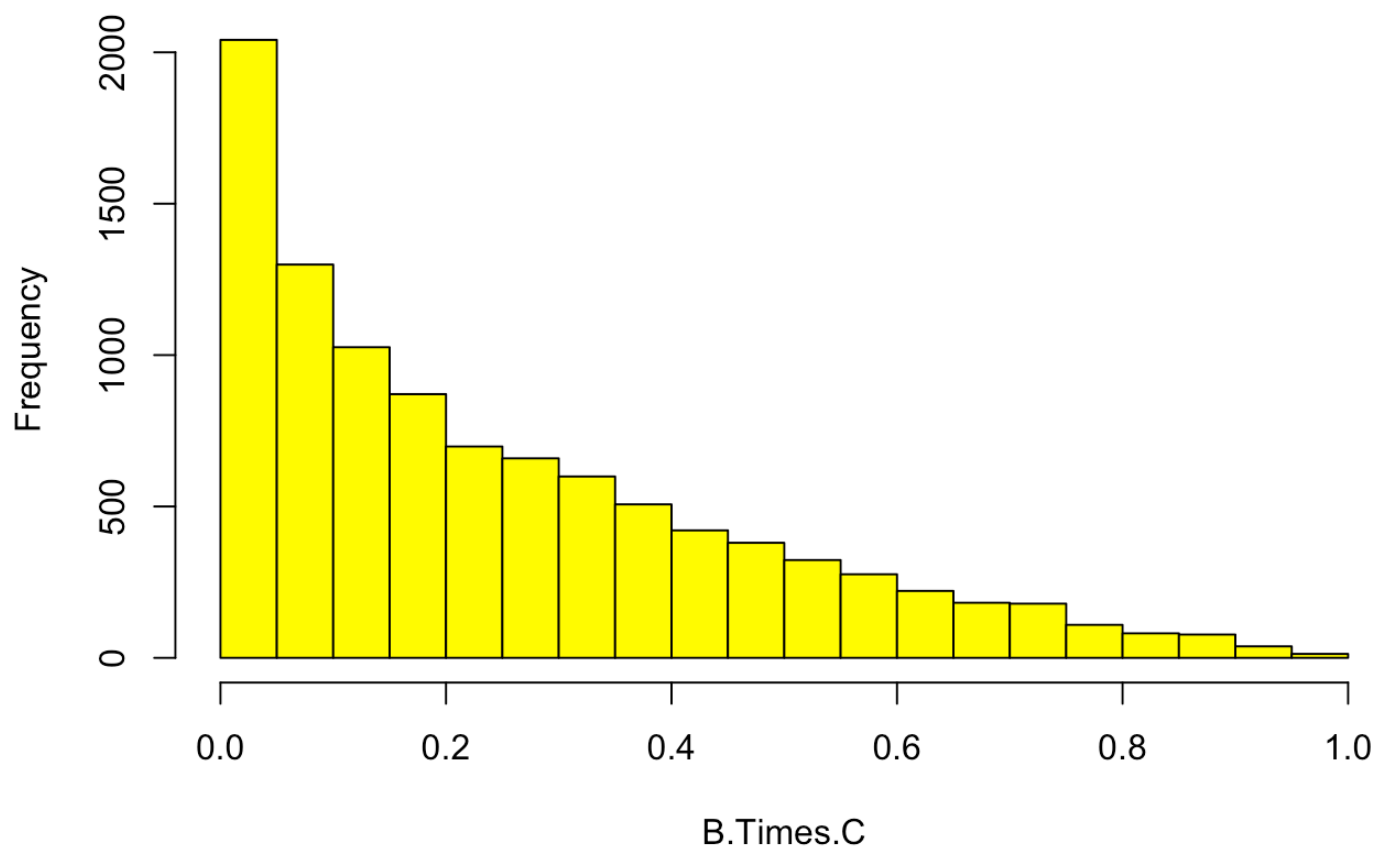
```
## [1] 0.1307
```

The probability that B + C < 1/2 approaches 0.13

(b) BC < 1/2.

```
#B*C < 1/2
B.Times.C <- B*C
hist(B.Times.C, col = "yellow", breaks=20)
```

Histogram of B.Times.C


```r
length(which(B.Times.C < 1/2))/length(B.Times.C)
```
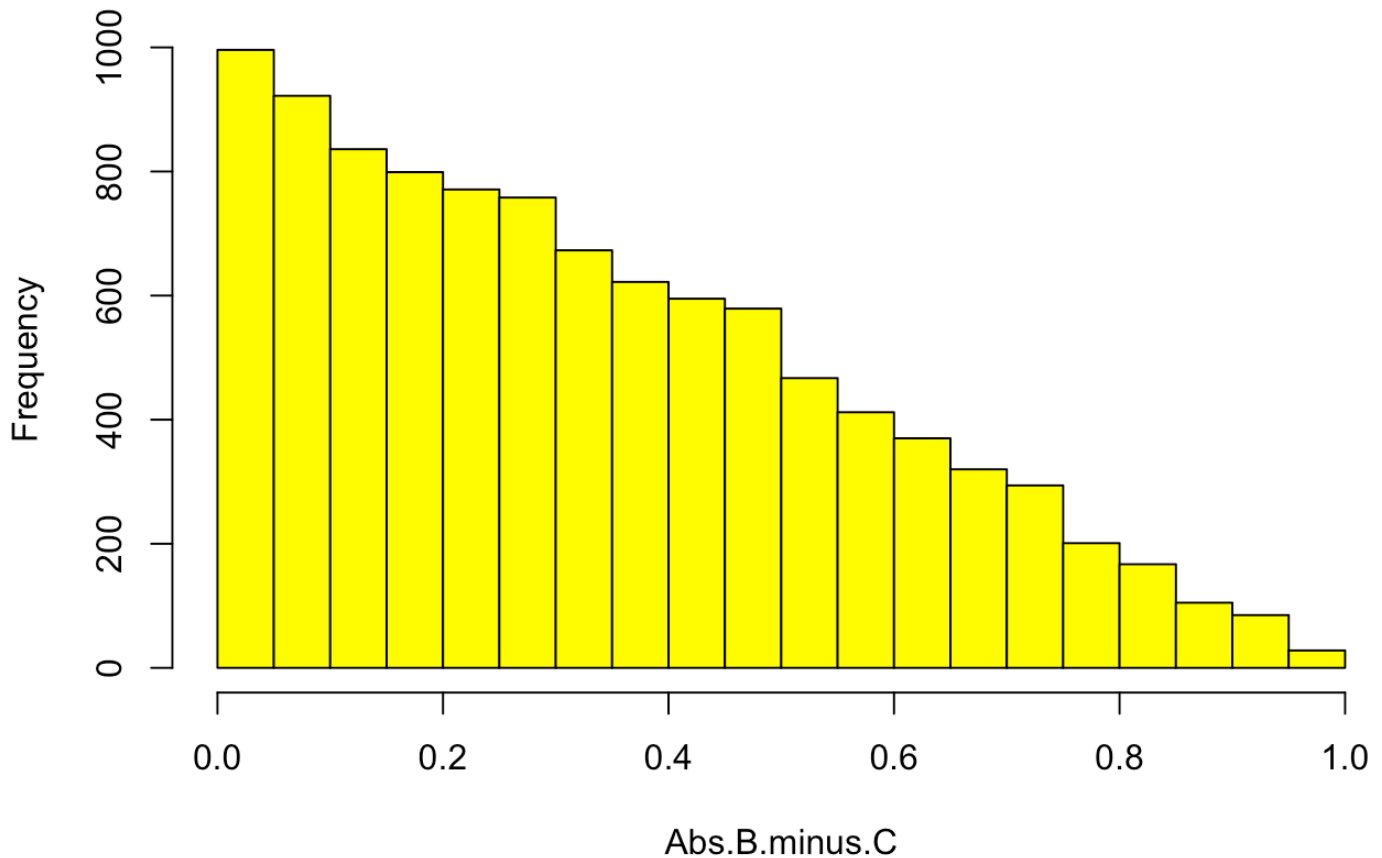
```
## [1] 0.8501
```

The probability that BC < 1/2 approaches 0.85

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

```r
#abs(B - C) < 1/2
Abs.B.minus.C <- abs(B - C)
hist(Abs.B.minus.C, col = "yellow", breaks=20)
```

Histogram of Abs.B.minus.C


```
length(which(Abs.B.minus.C < 1/2))/length(Abs.B.minus.C)
```
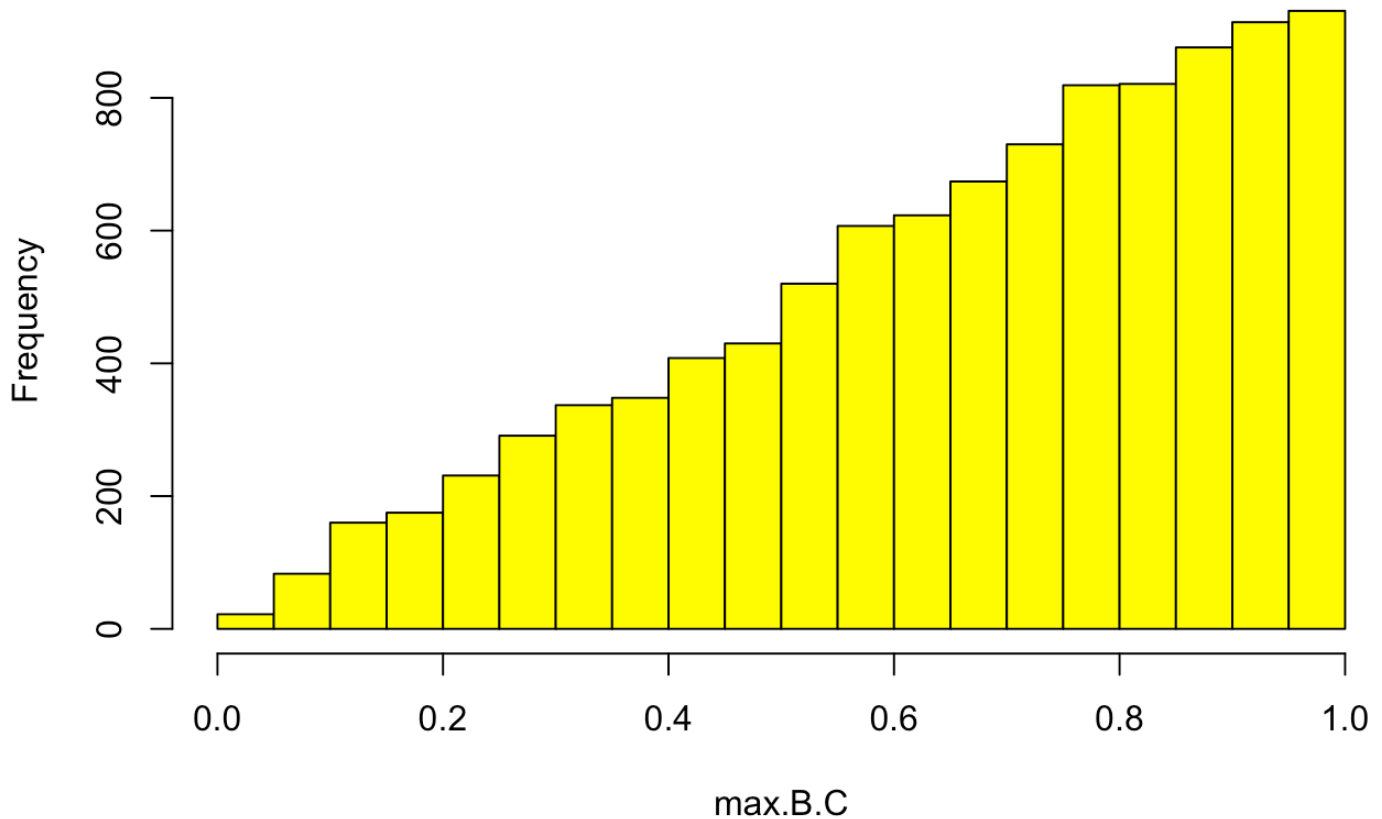
```
## [1] 0.7551
```

The probability that |B − C| < 1/2 approaches 0.75

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

```
#max{B,C}
max.B.C <- pmax(B,C)
hist(max.B.C, col = "yellow", breaks=20)
```

Histogram of max.B.C
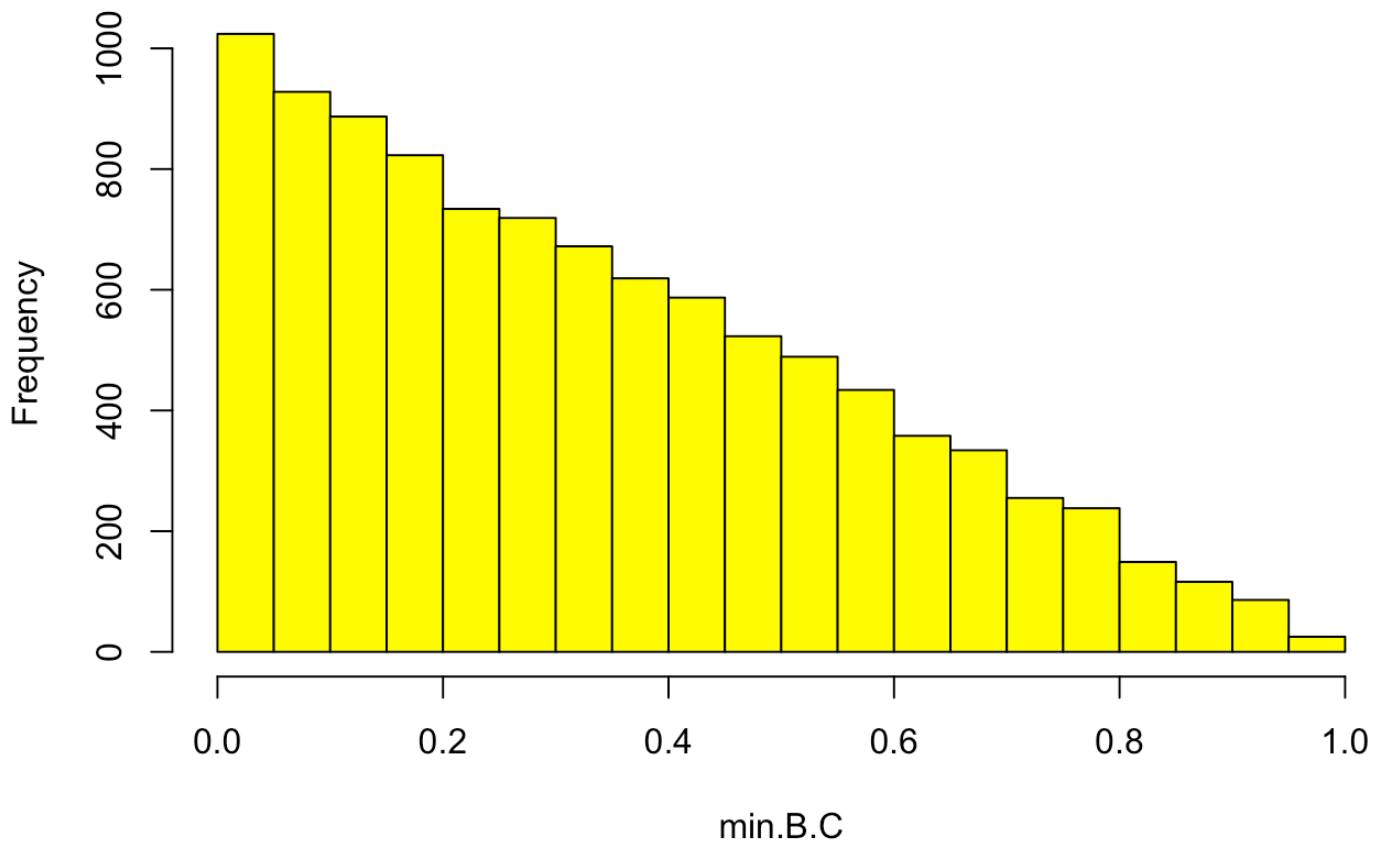

max.B.C

```
length(which(max.B.C < 1/2))/length(max.B.C)
```

```
## [1] 0.2485
```

The probability that max{B,C} < 1/2 approaches 0.25

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

```
min.B.C <- pmin(B,C)
hist(min.B.C, col = "yellow", breaks=20)
```

Histogram of min.B.C


```
length(which(min.B.C < 1/2))/length(min.B.C)
```

```
## [1] 0.7516
```

The probability that min{B,C} < 1/2 approaches 0.75