

HW6

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Question 1

```
nsim <- 1000000
mu <- c(0, -1, 1)
sigma <- matrix(c(10, 3, 5, 3, 15, 10, 5, 10, 40), ncol = 3)
```

a)

```
set.seed(740)
a1 <- rmvnorm(nsim, mean = mu, sigma = sigma)
mean(a1[,3] > 1)
```

[1] 0.500149

About 50.01%

b)

```
mean(a1[,1] > 0 | a1[,2] > 0 | a1[,3] > 0)
```

[1] 0.796816

About 79.68%

c)

```
mean(a1[,1] > 0 & a1[,2] > 0 & a1[,3] > 0)
```

[1] 0.181384

About 18.14%

d)

```
a2 <- a1[,1] * a1[,2] * a1[,3]
mean(a2)
```

[1] -2.064684

```
var(a2)
```

[1] 10872.1

Mean = -2.06, Variance = 10872.1

e)

```
a3 <- apply(a1, 1, max)
mean(a3)
```

[1] 3.50339

```
var(a3)
```

[1] 18.4167

Mean = 3.50, Variance = 18.42

f)

```
cov(a2, a3)
```

[1] 185.0303

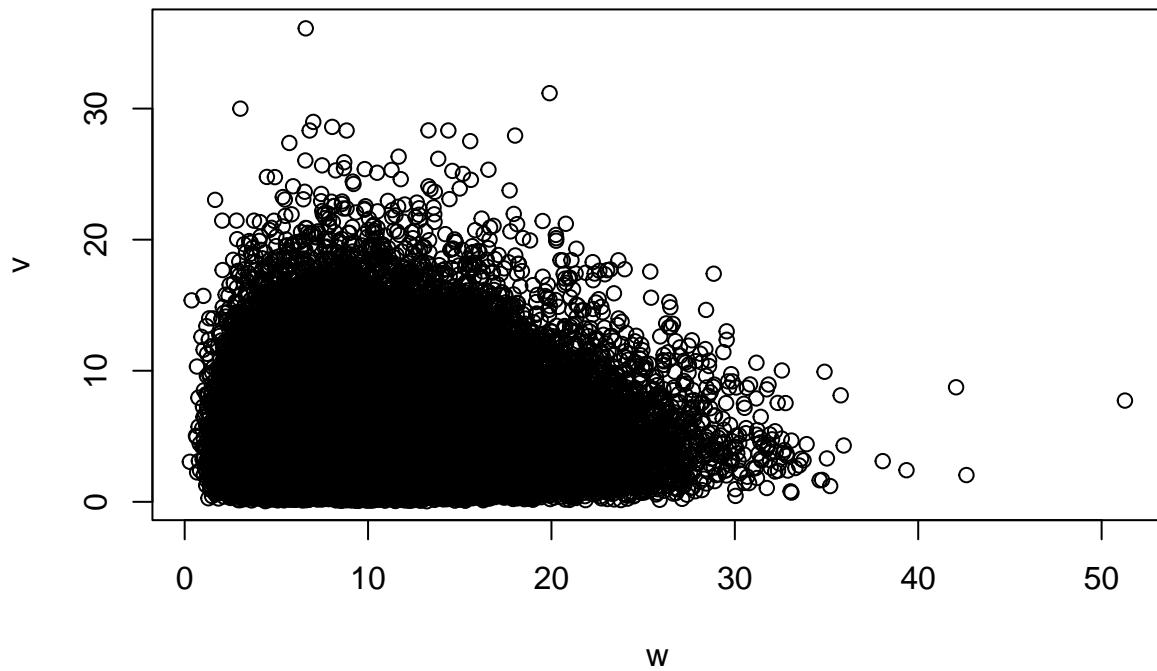
Covariance = 185.03

Question 2

```
nsim <- 100000
set.seed(740)
v <- rchisq(nsim, 5)
w <- rchisq(nsim, 10)
```

a)

```
plot(v ~ w)
```



b)

```
mean(v > w)
```

```
## [1] 0.16537
```

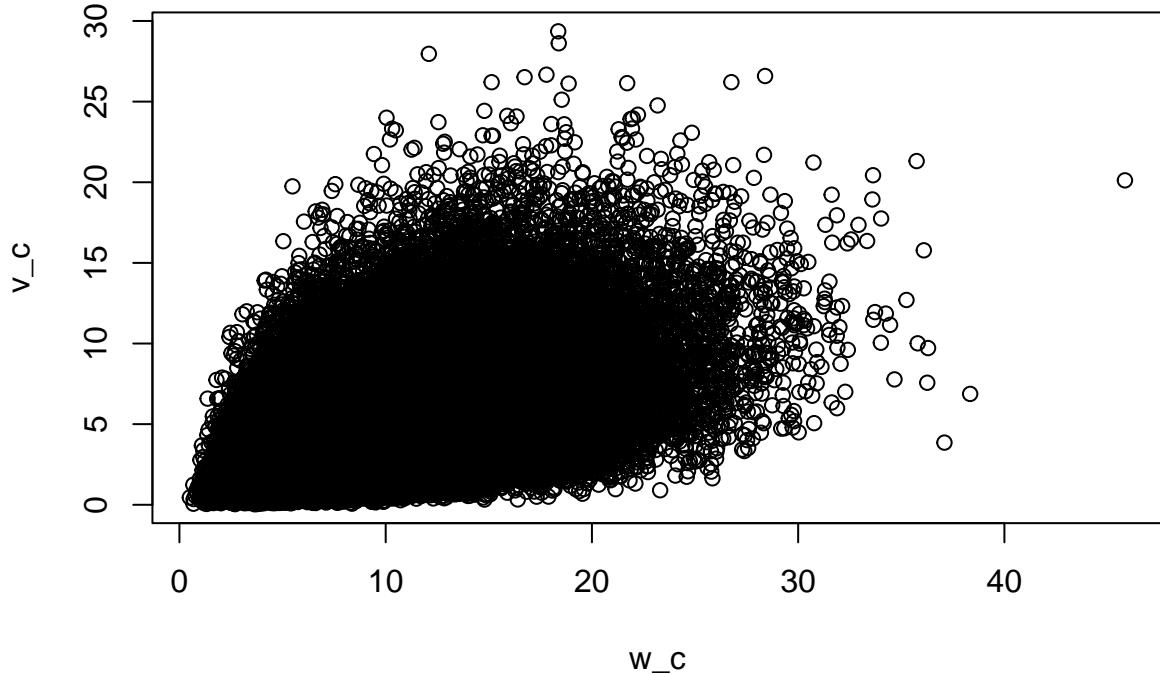
About 16.54%

c)

```
set.seed(740)
cop <- rCopula(nsim, copula = normalCopula(0.5, dim = 2, dispstr = "un"))

v_c <- qchisq(cop[,1], 5)
w_c <- qchisq(cop[,2], 10)

plot(v_c ~ w_c)
```



d)

```
mean(v_c > w_c)
```

```
## [1] 0.08426
```

About 8.43%

e)

```
cor <- c(-1, -.75, -0.5, -.25, 0, .25, .5, .75, 1)
prob <- c()

set.seed(740)
for (i in cor) {
  cop <- rCopula(nsim, copula = normalCopula(i, dim = 2, dispstr = "un"))

  v_c <- qchisq(cop[, 1], 5)
  w_c <- qchisq(cop[, 2], 10)

  p <- mean(v_c > w_c)

  prob <- c(prob, p)
}
```

```
prob
```

```
## [1] 0.24436 0.22915 0.21650 0.19101 0.16345 0.12878 0.08257 0.02681 0.00000
```

```
plot(prob ~ cor)
```

