PROBABILITY AND STATISTICS

(UCS410)

ASSIGNMENT 6

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1.



CODE –

# Define the joint probability density function

f <- function(x, y) {

if (x >= 0 & x < y & y <= 1) {

return(18 \* x^2 \* y^2)

} else {

return(0)

}

}

# Define the range of integration

xmin <- 0

xmax <- 1

ymin <- function(x) x

ymax <- 1

# Define the step size for the Riemann sum approximation

step <- 0.001

# Find E(X)

EX <- 0

for (x in seq(xmin, xmax, step)) {

for (y in seq(ymin(x), ymax, step)) {

EX <- EX + x \* f(x, y) \* step^2

}

}

print(paste0("E(X) = ", EX))

# Find E(Y)

EY <- 0

for (y in seq(ymin(0), ymax, step)) {

for (x in seq(0, y, step)) {

EY <- EY + y \* f(x, y) \* step^2

}

}

print(paste0("E(Y) = ", EY))

# Find E(XY)

EXY <- 0

for (x in seq(xmin, xmax, step)) {

for (y in seq(ymin(x), ymax, step)) {

EXY <- EXY + x \* y \* f(x, y) \* step^2

}

}

print(paste0("E(XY) = ", EXY))

# Find Covariance(X, Y)

covXY <- EXY - EX \* EY

print(paste0("Covariance(X, Y) = ", covXY))

# Check for independence

if (covXY == 0) {

print("X and Y are independent")

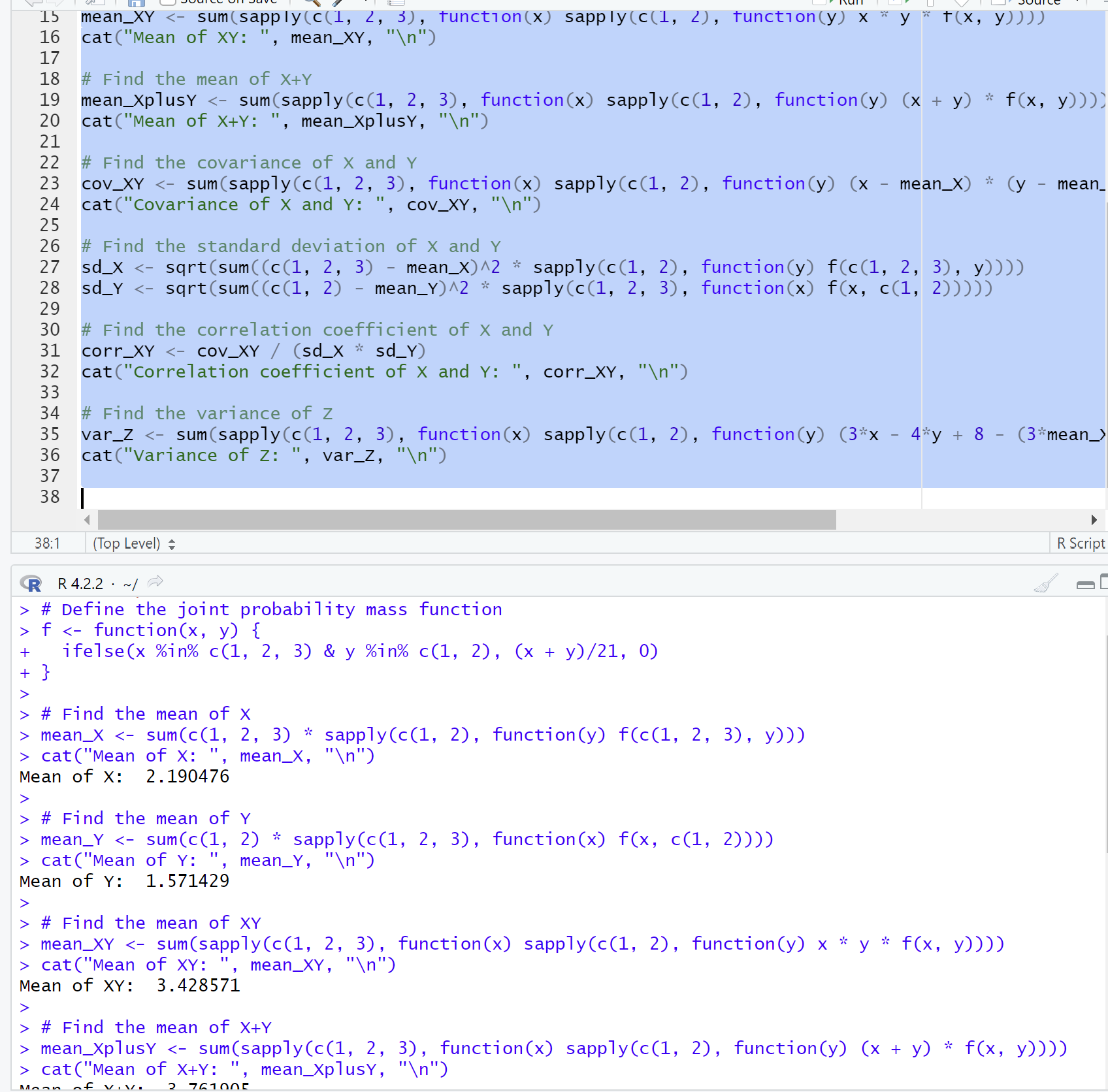
} else {

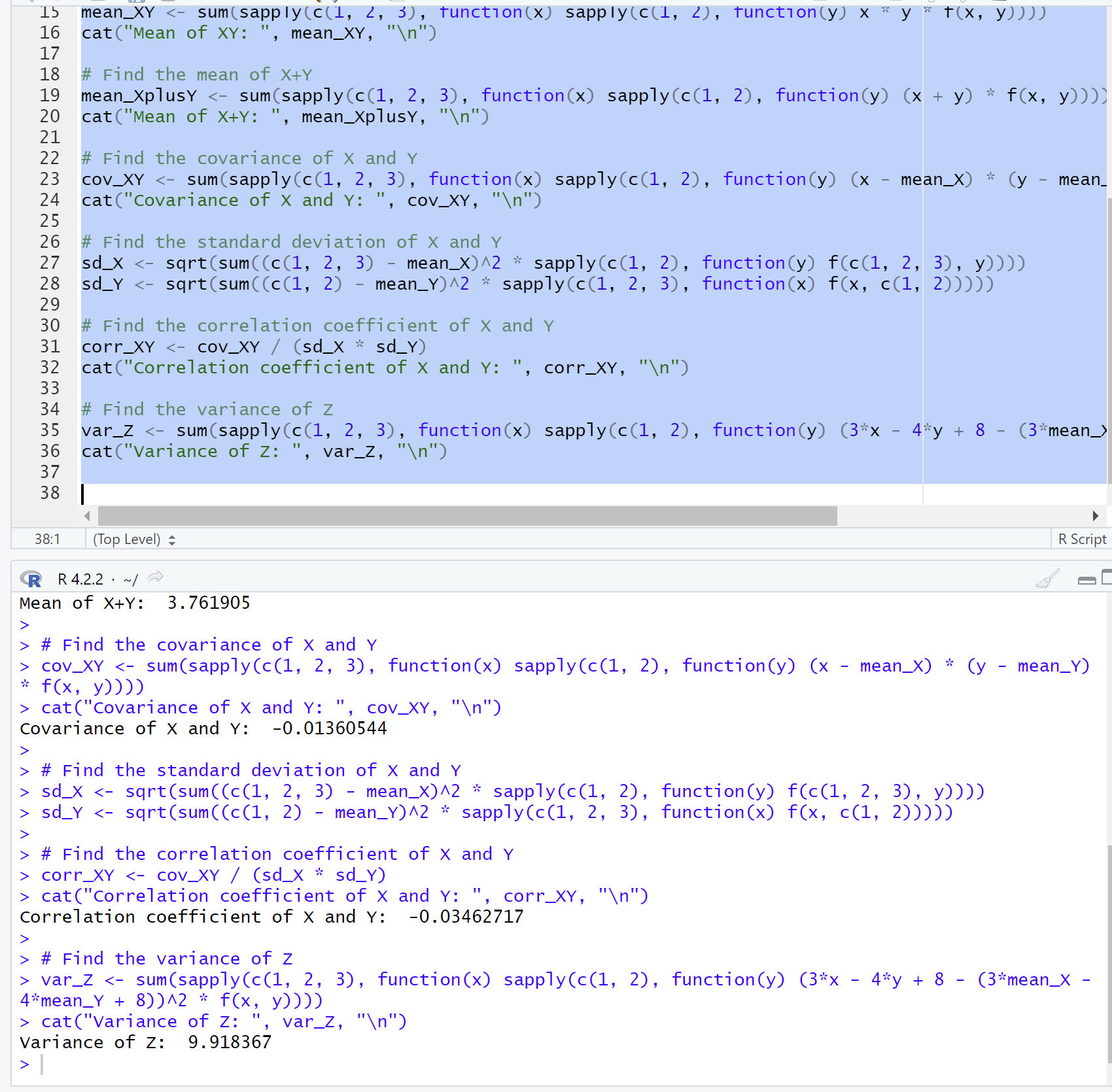
print("X and Y are not independent")

}

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2.





CODE –

# Define the joint probability mass function

f <- function(x, y) {

ifelse(x %in% c(1, 2, 3) & y %in% c(1, 2), (x + y)/21, 0)

}

# Find the mean of X

mean\_X <- sum(c(1, 2, 3) \* sapply(c(1, 2), function(y) f(c(1, 2, 3), y)))

cat("Mean of X: ", mean\_X, "\n")

# Find the mean of Y

mean\_Y <- sum(c(1, 2) \* sapply(c(1, 2, 3), function(x) f(x, c(1, 2))))

cat("Mean of Y: ", mean\_Y, "\n")

# Find the mean of XY

mean\_XY <- sum(sapply(c(1, 2, 3), function(x) sapply(c(1, 2), function(y) x \* y \* f(x, y))))

cat("Mean of XY: ", mean\_XY, "\n")

# Find the mean of X+Y

mean\_XplusY <- sum(sapply(c(1, 2, 3), function(x) sapply(c(1, 2), function(y) (x + y) \* f(x, y))))

cat("Mean of X+Y: ", mean\_XplusY, "\n")

# Find the covariance of X and Y

cov\_XY <- sum(sapply(c(1, 2, 3), function(x) sapply(c(1, 2), function(y) (x - mean\_X) \* (y - mean\_Y) \* f(x, y))))

cat("Covariance of X and Y: ", cov\_XY, "\n")

# Find the standard deviation of X and Y

sd\_X <- sqrt(sum((c(1, 2, 3) - mean\_X)^2 \* sapply(c(1, 2), function(y) f(c(1, 2, 3), y))))

sd\_Y <- sqrt(sum((c(1, 2) - mean\_Y)^2 \* sapply(c(1, 2, 3), function(x) f(x, c(1, 2)))))

# Find the correlation coefficient of X and Y

corr\_XY <- cov\_XY / (sd\_X \* sd\_Y)

cat("Correlation coefficient of X and Y: ", corr\_XY, "\n")

# Find the variance of Z

var\_Z <- sum(sapply(c(1, 2, 3), function(x) sapply(c(1, 2), function(y) (3\*x - 4\*y + 8 - (3\*mean\_X - 4\*mean\_Y + 8))^2 \* f(x, y))))

cat("Variance of Z: ", var\_Z, "\n")