# Homework 6

## Code:

```r
1   # HW 6 Mean and Variance of Conditional Joint Probability Function
2   # Inthat Sappipat 65011304
3
4   options(scipen = 999) # set the display format for large numbers
5
6   con_mean_var <- function(x) { # create a function named con_mean_var to find the conditional
7                                 # mean and variance of Y when X = x
8
9     joint <- matrix(c(0.01, 0.02, 0.02, 0.15, 0.02, 0.03, 0.10, 0.10, 0.25, 0.20, 0.05, 0.05),
10                   nrow = 4, ncol = 3, dimnames = list(c("y1", "y2", "y3", "y4"),
11                   c("x1", "x2", "x3"))) # Create a matrix named joint to show a conditional
12                                         # joint probability distribution
13
14    y = c(1, 2, 3, 4) # create a variable named y to store array of 1,2,3,4
15
16    prob = apply(joint, 2, sum) # create a variable named prob to calculate the marginal
17                                # probabilities
18
19    con_prob = joint[,x] / prob[x] # create a variable named con_prob to calculate the
20                                   # conditional probabilities
21
22    mean = sum(y * con_prob) # calculate the mean
23
24    var = sum((y - mean) ^ 2 * con_prob) # calculate the variance
25
26    cat("E( Y|x =", x, ") = ", mean, "\n") # show the output of mean
27
28    cat("Var( Y|x =", x, ") = ", var, "\n") # show the output of variance
29
30  }
31
32  con_mean_var(1) #run the function with x = 1
33  con_mean_var(2) #run the function with x = 2
34  con_mean_var(3) #run the function with x = 3
```

## Result:

```
> joint(1) #run the function with x = 1
E( Y|x = 1 ) =  3.55
Var( Y|x = 1 ) =  0.7475

> joint(2) #run the function with x = 2
E( Y|x = 2 ) =  3.12
Var( Y|x = 2 ) =  0.8256

> joint(3) #run the function with x = 3
E( Y|x = 3 ) =  1.818182
Var( Y|x = 3 ) =  0.8760331
```

## Conclusion:

From the experiment, the conditional mean and variance of Y when X = 1 are 3.55 and 0.7475, the conditional mean and variance of Y when X = 2 are 3.12 and 0.8256, and the conditional mean and variance of Y when X = 3 are 1.818182 and 0.8760331. Comparing these to the result that comes from the calculator is the same. In my opinion, the function that I created and the theoretical calculations are consistent.