HW\_10

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## HW 20.1-1 a, b, c

random <- c(.3039, .7914, .8543, .6902, .3004, .0383)  
  
# a)unbiased coin  
flips <- character()  
for(i in random){  
 if(i < .50){  
 flips <- c(flips, "Heads")  
 }  
 else{  
 flips <- c(flips, "Tails")  
 }  
}  
  
# b) Pitcher 60% strikes, 40% balls  
pitches <- character()  
for(i in random){  
 if(i < .60){  
 pitches <- c(pitches, "Strike")  
 }  
 else{  
 pitches <- c(pitches, "Ball")  
 }  
}  
  
# c) traffic light Green 40%, Yellow 10%, Red 50%  
lights <- character()  
for(i in random){  
 if(i < .10){  
 lights <- c(lights, 'yellow')  
 }else if(i >= .10 & i <.50){  
 lights <- c(lights, 'green')  
 }else {  
 lights <- c(lights, 'red')  
 }  
}  
  
flips

## [1] "Heads" "Tails" "Tails" "Tails" "Heads" "Heads"

pitches

## [1] "Strike" "Ball" "Ball" "Ball" "Strike" "Strike"

lights

## [1] "green" "red" "red" "red" "green" "yellow"

## HW 20.1-2 a, b

#a)  
rand <- c(.3004,.0383,.3883,.6052,.2231,.4250,.3729,.7983,.2340,.0082)  
  
weather <- character()  
yesterday <- 'clear'  
  
for(r in rand){  
 if(yesterday == 'clear' & r >= .20){  
 weather <- c(weather, 'clear')  
 yesterday <- 'clear'  
 }else if(yesterday == 'clear' & r < .20){  
 weather <- c(weather, 'rainy')  
 yesterday <- 'rainy'  
 }else if(yesterday == 'rainy' & r >= .40){  
 weather <- c(weather, 'rainy')  
 yesterday <- 'rainy'  
 }else if(yesterday == 'rainy' & r < .40){  
 weather <- c(weather, 'clear')  
 yesterday <- 'clear'  
 }  
}  
  
print("weather part a:")

## [1] "weather part a:"

weather

## [1] "clear" "rainy" "clear" "clear" "clear" "clear" "clear" "clear"  
## [9] "clear" "rainy"

#b)  
set.seed(33)  
rand\_b <- runif(10, 0, 1)  
  
weather\_b <- character()  
yesterday\_b <- 'clear'  
  
for(b in rand\_b){  
 if(yesterday\_b == 'clear' & b > .20){  
 weather\_b <- c(weather\_b, 'clear')  
 yesterday\_b <- 'clear'  
 }else if(yesterday\_b == 'clear' & b <= .20){  
 weather\_b <- c(weather\_b, 'rainy')  
 yesterday\_b <- 'rainy'  
 }else if(yesterday\_b == 'rainy' & b > .40){  
 weather\_b <- c(weather\_b, 'rainy')  
 yesterday\_b <- 'rainy'  
 }else if(yesterday\_b == 'rainy' & b <= .40){  
 weather\_b <- c(weather\_b, 'clear')  
 yesterday\_b <- 'clear'  
 }  
}  
  
print("weather part b:")

## [1] "weather part b:"

weather\_b

## [1] "clear" "clear" "clear" "clear" "clear" "clear" "clear" "clear"  
## [9] "rainy" "clear"

## HW 20.1-3 a, b, c, d, e

#a)  
two\_sold = 4/25  
three\_sold = 7/25  
four\_sold = 8/25  
five\_sold = 5/25  
six\_sold = 1/25  
print(paste(two\_sold,three\_sold, four\_sold,five\_sold,six\_sold))

## [1] "0.16 0.28 0.32 0.2 0.04"

#b)  
sales <- c(rep(2,4), rep(3,7), rep(4,8), rep(5,5), 6)  
avg\_sales\_over\_25\_days <- mean(sales)  
avg\_sales\_over\_25\_days

## [1] 3.68

#c) answer below  
  
#d)  
uni = c(.4476, .9713, .0629)  
three\_day = double()  
  
for(s in uni){  
 if(s <.16){  
 three\_day <- c(three\_day, 2)  
 }else if(s >= .16 & s < .4399){  
 three\_day <- c(three\_day, 3)  
 }else if(s >= .44 & s < .7599){  
 three\_day <- c(three\_day, 4)  
 }else if(s >= .76 & s < .9599){  
 three\_day <- c(three\_day, 5)  
 }else{  
 three\_day <- c(three\_day, 6)  
 }   
}  
  
three\_day

## [1] 4 6 2

mean(three\_day)

## [1] 4

mean(three\_day) - avg\_sales\_over\_25\_days

## [1] 0.32

#e)  
set.seed(44)  
sales\_sim <- sample(sales, 300, replace = TRUE)  
mean\_sim <- mean(sales\_sim)  
mean\_sim

## [1] 3.613333

1. P(Two Stoves) = 4/25, P(Three Stoves) = 7/25, P(Four Stoves) = 8/25, P(Five Stoves) = 5/25, P(Six Stoves) = 1/25
2. Average of 3.68 stoves
3. Similar to 20.1-1 where probability ranges are assigned to the number of stoves being sold. This is illustrated in part d.
4. .4476 would equal 4 stoves, .9713 would equal 6 stoves, .0629 would equal 2 stoves. This averages to 4 stoves per day which exceeds the 25 day mean by 0.32 stoves
5. The 300 day simulation resulted in an average of 3.613 stoves per day, .067 stoves/day less than the 25 day average.

## HW 20.4-3

#a)  
print("Part a")

## [1] "Part a"

set.seed(22)  
runif(3, 25, 75)

## [1] 40.21384 48.73695 74.67629

#b)  
print("Part b")

## [1] "Part b"

set.seed(22)  
obs <- runif(3, -1, 1)  
for(x in obs){  
 u <- (1/16)\*(1 + x)^4  
 print(paste("u =", u, " and x =", x))  
}

## [1] "u = 0.00857186974659506 and x = -0.391446329187602"  
## [1] "u = 0.0507948061976839 and x = -0.0505221830680966"  
## [1] "u = 0.974353497608607 and x = 0.987051543779671"

#c)  
print("Part c")

## [1] "Part c"

set.seed(22)  
obs <- runif(3, 40, 60)  
for(x in obs){  
 u <- (1/400)\*(x-40)^2  
 print(paste("u =", u, " and x =", x))  
}

## [1] "u = 0.0925843925648112 and x = 46.085536708124"  
## [1] "u = 0.225377031211443 and x = 49.494778169319"  
## [1] "u = 0.987093459409294 and x = 59.8705154377967"

## HW 20.4-11

#a) and b)  
y <- c(.2655, .3472, .0248, .9205, .6130)  
  
#line between (7,0) and (9,.2): y = .1x -.7  
  
#line between (9,.2) and (11,.8): y = .3x + -2.5  
  
#line between (11,.8) and (13,1): y = .1x -.3  
  
for(r in y){  
 if(r < .2){  
 time <- (r+.7)/.1  
 print(paste('Uniform Random # = ', r, 'Observation = ', time))  
 }else if(r >= .2 & r < .8 ){  
 time <- (r + 2.5)/.3  
 print(paste('Uniform Random # = ', r, 'Observation = ', time))  
 }else{  
 time <- (r + .3)/.1  
 print(paste('Uniform Random # = ', r, 'Observation = ', time))  
 }   
}

## [1] "Uniform Random # = 0.2655 Observation = 9.21833333333333"  
## [1] "Uniform Random # = 0.3472 Observation = 9.49066666666667"  
## [1] "Uniform Random # = 0.0248 Observation = 7.248"  
## [1] "Uniform Random # = 0.9205 Observation = 12.205"  
## [1] "Uniform Random # = 0.613 Observation = 10.3766666666667"

## HW 20.6-1 a, b, c

#a)  
set.seed(101)  
simulations <- 100  
  
purchasePrice <- 1.50  
salesPrice <- 2.50  
refundPrice <- 0.50  
  
copiesOrdered <- 60  
  
print('Part a: 100 Simulations')

## [1] "Part a: 100 Simulations"

for(i in 1:5){  
 copiesSold <- sample(40:70, simulations, replace = TRUE)  
 SalesRevenue <- salesPrice\*pmin(copiesOrdered,copiesSold)  
 PurchasingCost <- purchasePrice\*copiesOrdered  
 Refund <- refundPrice\*pmax(copiesOrdered-copiesSold,0)  
 Profit <- SalesRevenue-PurchasingCost+Refund  
 avgProfit <- mean(Profit)  
 print(avgProfit)  
}

## [1] 47.56  
## [1] 47.1  
## [1] 45.04  
## [1] 45.96  
## [1] 48.28

#b)  
set.seed(101)  
simulations <- 1000  
  
purchasePrice <- 1.50  
salesPrice <- 2.50  
refundPrice <- 0.50  
  
copiesOrdered <- 60  
  
print('Part b: 1000 Simulations')

## [1] "Part b: 1000 Simulations"

for(i in 1:5){  
 copiesSold <- sample(40:70, simulations, replace = TRUE)  
 SalesRevenue <- salesPrice\*pmin(copiesOrdered,copiesSold)  
 PurchasingCost <- purchasePrice\*copiesOrdered  
 Refund <- refundPrice\*pmax(copiesOrdered-copiesSold,0)  
 Profit <- SalesRevenue-PurchasingCost+Refund  
 avgProfit <- mean(Profit)  
 print(avgProfit)  
}

## [1] 46.06  
## [1] 47.196  
## [1] 46.214  
## [1] 45.724  
## [1] 47.134

1. The average profits in part ‘a’ have a wider range, where the average profits in part ‘b’ are more consistent.

## HW 20.6-2

library(triangle)  
library(FinancialMath)  
  
#a)  
set.seed(99)  
land <- -1000000 #cost of land  
construction <- rtriangle(1000, -2400000, -1600000) #cost of construction  
  
#Years 1-4 cash flows  
Yr1\_cash\_flow <- construction  
Yr2\_cash\_flow <- rnorm(1000, 700000, 700000)  
Yr3\_cash\_flow <- rnorm(1000, 700000, 700000)  
Yr4\_cash\_flow <- rnorm(1000, 700000, 700000)  
  
Yr5\_prof\_or\_loss <- rnorm(1000, 700000, 700000) #Year 5 profit/loss  
sale\_price <- runif(1000, 4000000, 8000000) #Estimated Sale Price EOY 5  
  
Yr5\_cash\_flow <- Yr5\_prof\_or\_loss+sale\_price #Year 5 cash flow  
  
#NPV simulated 1000 times  
NPValues <- double()  
for(i in 1:length(sale\_price)){  
 NetPresentValue <- NPV(land, c(Yr1\_cash\_flow[i], Yr2\_cash\_flow[i], Yr3\_cash\_flow[i], Yr4\_cash\_flow[i], Yr5\_cash\_flow[i]), c(1:5), .10)  
 NPValues <- c(NPValues, NetPresentValue)  
}  
  
#hist(NPValues)  
avg\_NPV <- mean(NPValues)  
sd\_NPV <- sd(NPValues)  
avg\_NPV

## [1] 2954415

#b)  
two\_mill <- pnorm(2000000, mean = avg\_NPV, sd = sd\_NPV, lower.tail = FALSE)  
two\_mill

## [1] 0.7751199

#c)  
min\_profits <- pmin(Yr2\_cash\_flow, Yr3\_cash\_flow, Yr4\_cash\_flow, Yr5\_prof\_or\_loss)  
avg\_min <- mean(min\_profits)  
avg\_min

## [1] -4956.576

#d)  
#Probability of annual operating profit of at least 0 in all four years  
zero\_profit <- pnorm(0, mean = mean(Yr4\_cash\_flow), sd = sd(Yr4\_cash\_flow), lower.tail = FALSE)^4  
zero\_profit

## [1] 0.5023903

1. The mean net present value of the project is $2,954,415.
2. The estimated probability that the project will yield an NPV of $2 million is 77.5%.
3. The average minimum annual operating profit over four years is actually a loss of $4,956.58.
4. The probability that the annual operating profit will be at least 0 in all four years of operation is 50.2%.