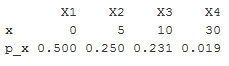
Week 3 Assignment Math - Puneet Auluck

### Short Answers:

* **2.34**
  + 1.  E(x) = 4.13, SD = 3.41
    2. $4 maximum
* **2.40**
  + 1.  E(x) = 12.7, SD = 10.09
    2. E(x) = 407.28,SD = 324.42
* **2.42**
  + 1. $72, SD = 6.40
    2. $11.00, SD = 0.40
* **2.46**
  + 1. symmetircal
    2. 0.26
    3. No, assumption not valid

### Detailed Answers:

Below are some functions that will be used for first 2 questions.

getExpectedValue <- function(x,y) {  
 return(sum(x \* y))  
}  
  
getVar <- function (x, e, p){  
 diff\_xe\_sq <- ((x\*p)-e)^2  
 return(sum(diff\_xe\_sq \* p))  
}  
  
getSD <- function(x){  
 return(sqrt(x))  
}  
  
buildPModel <- function(x,p){  
 return(data.frame(rbind(ceiling(x), format((p),digits=2)),row.names = c("x","p\_x")))  
}

**2.34 Card game. Consider the following card game with a well-shuffled deck of cards. If you draw a red card, you win nothing. If you get a spade,you win $5. For any club, you win $10 plus an extra $20 for the ace of clubs.**

(a) Create a probability model for the amount you win at this game. Also, find the expected winnings for a single game and the standard deviation of the winnings.

x <- c(0,5,10,30)  
p\_x <- c(26/52,13/52,12/52,1/52)  
e <- getExpectedValue(x,p\_x)  
v <- getVar(x,e,p\_x)  
s <- getSD(v)  
  
print(buildPModel(x,p\_x))

## X1 X2 X3 X4  
## x 0 5 10 30  
## p\_x 0.500 0.250 0.231 0.019

sprintf("Average revenue %1.2f, variance: %1.2f, standard deviation: %1.2f", e, v,s)

## [1] "Average revenue 4.13, variance: 11.64, standard deviation: 3.41"

(b) What is the maximum amount you would be willing to pay to play this game? Explain.

The maximum amount I am willing to pay is $4 which is near to the expected value. If I play this game 100 times, with the expected value of $4.13, I would profit $13.  
If I play this game 100 times @ $5/game, I should expect a loss of $87.

**2.40 Baggage Fees. An airline charges the following baggage fees: $25 for the first bag and $35 for the second. Suppose 54% of passengers have no checked luggage, 34% have one piece of checked luggage and 12% have two pieces. We suppose a negligible portion of people check more than two bags.**

*(a) Build a probability model, compute the average revenue per passenger, and compute the corresponding standard deviation.*

x <- c(0,25,35)  
p\_x <- c(0.54,0.34, 0.12)  
  
e <- getExpectedValue(x,p\_x)  
v <- getVar(x,e,p\_x)  
s <- getSD(v)  
  
  
print(buildPModel(x,p\_x))

## X1 X2 X3  
## x 0 25 35  
## p\_x 0.54 0.34 0.12

sprintf("Average revenue per passenger %1.2f, variance: %1.2f, standard deviation: %1.2f", e, v,s)

## [1] "Average revenue per passenger 12.70, variance: 101.76, standard deviation: 10.09"

*(b) About how much revenue should the airline expect for a flight of 120 passengers? With what standard deviation? Note any assumptions you make and if you think they are justified.*

x <- c(120\*.54\*0, 120\*.34\*25,120\*.12\*35)  
  
e <- getExpectedValue(x,p\_x)  
v <- getVar(x,e,p\_x)  
s <- getSD(v)  
sprintf("The expected revenue should be: $%1.2f, with standard deviation of: %1.2f", e, s)

## [1] "The expected revenue should be: $407.28, with standard deviation of: 324.42"

We make the assumption that the 120 passengers are random variables and none of the passengers are associated with each other.

**2.42 Selling on Ebay. Marcie has been tracking the following two items on Ebay: A textbook that sells for an average of $110 with a standard deviation of $4 and Mario Kart for the Nintendo Wii, which sells for an average of $38 with a standard deviation of $5.**

*(a) Marcie wants to sell the video game and buy the textbook. How much net money (profits - losses) would she expect to make or spend? Also compute the standard deviation of how much she would make or spend.*

book\_e <- 110  
book\_s <- 4  
game\_e <- 38  
game\_s <- 5  
# Expected value of expenditure is: E(book - game) = E(book)-E(game)  
sprintf("Marcie should expect to spend: $%1.2f", abs(110-38))

## [1] "Marcie should expect to spend: $72.00"

# Standard deviation: (-1)^\*var(book)+(1)^2\*var(game)  
sprintf("With standard deviation is %1.2f. ", sqrt((book\_s^2)+(game\_s^2)))

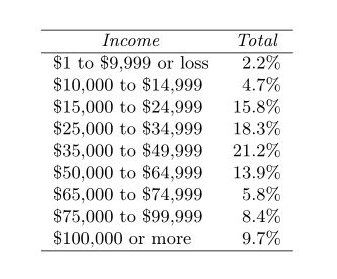
## [1] "With standard deviation is 6.40. "

*(b) Lucy is selling the textbook on Ebay for a friend, and her friend is giving her a 10% commission (Lucy keeps 10% of the revenue). How much money should she expect to make? With what standard deviation?*

sprintf("Lucy should expect to make: $%1.2f, with standard deviation of: %1.2f", 0.10\*book\_e, sqrt(0.10^2\*book\_s^2))

## [1] "Lucy should expect to make: $11.00, with standard deviation of: 0.40"

**2.46 Income and gender. The relative frequency table below displays the distribution of annual total personal income (in 2009 inflation-adjusted dollars) for a representative sample of 96,420,486 Americans. These data come from the American Community Survey for 2005-2009. This sample is comprised of 59% males and 41% females.**



(a) Describe the distribution of total personal income. The distribution appears to be symmetircal. It is heavily concentrated in the middle, meaning majority of the population's income is between 25K-50K.

(b) What is the probability that a randomly chosen US resident makes less than $50,000 per year?

income <- c(2.2,4.7,15.8,18.3,21.2,13.9,5.8,8.4,9.7)\*96420486/100  
p\_50less <- sum(income[1:5])/(96420486)  
sprintf("P(x<$50,000) is %1.2f. ", p\_50less)

## [1] "P(x<$50,000) is 0.62. "

(c) What is the probability that a randomly chosen US resident makes less than $50,000 per year and is female? Note any assumptions you make.

Assumption: propbability of person making less than 50K is independent of probability of being a female.

p\_female <- 0.41  
sprintf("P(x<$50,000 and female) is %1.2f:", p\_50less \* p\_female)

## [1] "P(x<$50,000 and female) is 0.26:"

(d) The same data source indicates that 71.8% of females make less than $50,000 per year. Use this value to determine whether or not the assumption you made in part (c) is valid.

No, because P(f) = 0.41 should be same as p(f) = P(female & less than 50K)\*P(50K) = (0.78)\*(0.622)=0.49 .