Homework 4

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Instructions: Complete the following problems using RMarkdown to render a Microsoft Word document. Include code in the space provided. If a direct question is asked, answer that question below the code input for that problem.

## Problem 1

Determine whether the random variable is discrete or continuous. In each case, state the possible values of the random variable.

1. The number of light bulbs that are out in the next week in a room with 20 bulbs. ## Discrete. You can’t have a fraction of a lightbult be out so the lightbulbs that are out would be in integers such as 1, 2, 3 that could be out in the next week.
2. The amount of snow in Toronto during winter. ## Continuous. There can be a lot of different amounts of snow just between 0 inch and 1 inch or even have anything high that can be in a decimal form.
3. The number of hits to a website in a day. ## Discrete. The number of hits would be in some some sort of integer such as 1,2, 1500. You cannot get a fraction of a hit.
4. The square footage of a house. ## Discrete. You could have sq-footage being from 500sqft to 1500sqrft or something like that.

## Problem 2

Determine whether the distribution is a discrete probability distribution. If not, state why.

|  |  |
| --- | --- |
| x | P(x) |
| 100 | 0.1 |
| 200 | 0.25 |
| 300 | 0.2 |
| 400 | 0.45 |
| 500 | 0.1 |

.1+.25+.2+.45+.1

## [1] 1.1

sprintf('This is not a discrete prob. dist. because the sum of probabilities add up to be 1.1 and not 1!')

## [1] "This is not a discrete prob. dist. because the sum of probabilities add up to be 1.1 and not 1!"

## Problem 3

In the 2004 baseball season Ichiro Suzuki of the Seattle Mariners set the record for the most hits in the season with a total of 262 hits. In the following probability distribution, the random variable represents the number of hits Ichiro hit in a game.

|  |  |
| --- | --- |
| x | P(x) |
| 0 | 0.1677 |
| 1 | 0.3354 |
| 2 | 0.2857 |
| 3 | 0.1491 |
| 4 | 0.0373 |
| 5 | 0.0248 |

1. Verify that this is a discrete probability distribution.

.1677+.3354+.2857+.1491+.0373+.0248

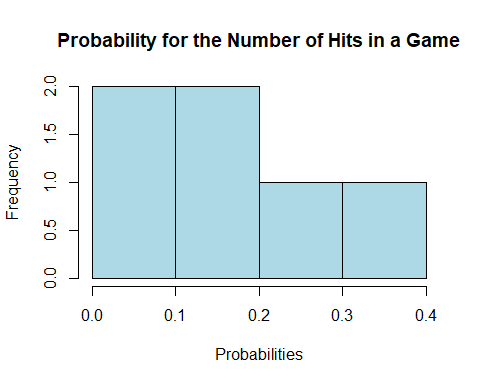
## [1] 1

sprintf("This is a prob. dist because everything adds up to 1 and all probs are between 0 and 1")

## [1] "This is a prob. dist because everything adds up to 1 and all probs are between 0 and 1"

1. Draw a graph of the probability distribution. Describe the shape of the distribution.

probs <- c( 0.1677 ,  
 0.3354 ,  
 0.2857 ,  
 0.1491 ,  
 0.0373 ,  
 0.0248 )  
hits <- c(0,1,2,3,4,5)  
hist(probs,xlab="Probabilities",main="Probability for the Number of Hits in a Game",col = 'light blue')



## The probability distribution is skewed right.

1. Compute and interpret the mean of the random variable .

mew = sum(hits\*probs)  
mew

## [1] 1.6273

sprintf("The mean of the random variable is %f and it shows that the expected number of hits will be about at most 2 hits per game.",mew)

## [1] "The mean of the random variable is 1.627300 and it shows that the expected number of hits will be about at most 2 hits per game."

1. Compute the standard deviation of the random variable .

stds = sqrt(sum((hits)^2 \* probs)- mew^2)  
stds

## [1] 1.178471

sprintf("The standard deviation is %f.",stds)

## [1] "The standard deviation is 1.178471."

1. What is the probability that in a randomly selected game Ichiro got 2 hits?

sprintf("The probability that Ichiro got 2 hits is %f.",probs[3])

## [1] "The probability that Ichiro got 2 hits is 0.285700."

1. What is the probability that in a randomly selected game Ichiro got more than one hit?

mt1 = 1 - (probs[1]+probs[2])  
mt1

## [1] 0.4969

sprintf("The probability that Ichiro got more than one hit is %f.",mt1)

## [1] "The probability that Ichiro got more than one hit is 0.496900."

## Problem 4

Determine if the following probability experiments represent a binomial experiment. If the probability experiment is not a binomial experiment, state why.

1. A random sample of 15 college seniors is obtained, and the individuals selected are asked to state their ages. ## It’s not a binomial experiment because there could be more than two outcomes since not every college senior will be the same age or even around the same age.
2. An experimental drug is administered to 100 randomly selected individuals, with the number of individuals responding favorably recorded. ## This is a binomial experiment.
3. A basketball player who makes 80% of her free throws is asked to shoot free throws until she misses. The number of free-throw attempts is recorded. ## This is not a binomial experiment because there are several different outcomes because we are taking the results of the number of attempts instead of if she made the free throw or not.

## Problem 5

In a recent poll, the Gallup Organization found that 45% of adult Americans believe that the overall state of moral values in United States is poor. Suppose a survey of a random sample of 25 adult Americans is conducted in which they are asked to disclose their feelings on the overall state of moral values in United States.

1. Find and interpret the probability that exactly 15 of those surveyed feel the state of morals is poor.

bin <- dbinom(15,25,.45)  
sprintf("The probability that exactly 15 people surveyed feel that the state of morals is poor is %f. This probability is showing that for all 15 people chosen to think that the state of morals is poor is a low probability.",bin)

## [1] "The probability that exactly 15 people surveyed feel that the state of morals is poor is 0.052023. This probability is showing that for all 15 people chosen to think that the state of morals is poor is a low probability."

1. Find and interpret the probability that no more than 10 of those surveyed feel the state of morals is poor.

pbin <- pbinom(10,25,.45)  
sprintf("The probability that no more than 10 people surveyed feel that the state of morals is poor is %f. This probability shows that there is a chance that ten people think this way out of the sample.",pbin)

## [1] "The probability that no more than 10 people surveyed feel that the state of morals is poor is 0.384260. This probability shows that there is a chance that ten people think this way out of the sample."

1. Find and interpret the probability that more than 16 of those surveyed feel the state of morals is poor.

sprintf("The probability that more than 16 people surveyed feel that the state of morals is poor is %f. This means that there is a very poor chance that this situation is true.", (1-pbinom(16,25,.45)))

## [1] "The probability that more than 16 people surveyed feel that the state of morals is poor is 0.017357. This means that there is a very poor chance that this situation is true."

1. Find and interpret the probability that 13 or 14 believe the state of morals is poor.

tru <- dbinom(13,25,.45) + dbinom(14,25,.45)  
sprintf("The probability that 13 or 14 people surveyed believe the state of morals is poor is %f. This shows that there is low but not too low of a chance that this could be true.",tru)

## [1] "The probability that 13 or 14 people surveyed believe the state of morals is poor is 0.210341. This shows that there is low but not too low of a chance that this could be true."

1. Would it be unusual to find 20 or more adult Americans believe the overall state of moral values is poor for any United States? Why?

## use the compliment for at least 20 adults  
com <- 1 - dbinom(20,25,.45)  
sprintf("The probability that atleast 20 adult Americans believe that the state of moral values is poor for the U.S. is %f. This isn't unusual because we are taking the compliment rule of the probability that twenty or less than twenty believe that the state of moral values is poor.",com)

## [1] "The probability that atleast 20 adult Americans believe that the state of moral values is poor for the U.S. is 0.999690. This isn't unusual because we are taking the compliment rule of the probability that twenty or less than twenty believe that the state of moral values is poor."

1. Find and interpret the mean of .

# mean = n\*p  
sprintf("The mean of X is %f and this means that approximately 11 people of the 25 surveyed would state that they believe that the state of moral values is poor.",(25\*.45))

## [1] "The mean of X is 11.250000 and this means that approximately 11 people of the 25 surveyed would state that they believe that the state of moral values is poor."

1. Find the standard deviation of .

##std = sqrt(n\*p\*(1-p))  
sprintf("The standard deviation of x is %f.",(25\*.45\*(1-.45)))

## [1] "The standard deviation of x is 6.187500."

## Problem 6

A telephone company’s goal is to have no more than five monthly line failures on any 100 miles of line. The company currently experiences in average of two monthly line failures per 50 miles of line. Let denote the number of monthly line failures per 100 miles of line. Assuming has a Poisson distribution:

1. Find the probability that the company will meet its goal on a particular 100 miles of line.

pd = ppois(5,4)  
sprintf("The probability that the company will meet it's goals is %f.",pd)

## [1] "The probability that the company will meet it's goals is 0.785130."

1. Find the probability that the company will not meet its goal on a particular 100 miles of line.

sprintf("The probability that he compnay will not meet its goal is %f.",(1 - ppois(5,4)))

## [1] "The probability that he compnay will not meet its goal is 0.214870."

1. Find the probability that the company will have no more than five monthly failures on a particular 200 miles of line.

sprintf("The probability that the company will have no more than five monthly failures on a particular 200 mi of line is %f.",(ppois(5,(4\*200)/100)))

## [1] "The probability that the company will have no more than five monthly failures on a particular 200 mi of line is 0.191236."

1. Compute the mean and standard deviation of for 300 miles of line.

mean = (4\*300)/100  
sig = sqrt(mean)  
sprintf("The mean would be %f and the standard deviation would be %f.",mean,sig)

## [1] "The mean would be 12.000000 and the standard deviation would be 3.464102."