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ADEC7310.02 – Data Analysis [Fulton]

Week 2 Homework

9/8/2017

2.6 **<u>Dice Rolls – If you roll a pair of fair dice, what is the probability of:</u>**

a) Getting a sum of 1? 0%

b) Getting a sum of 5? (4/36) = 11.11%

c) Getting a sum of 12? (1/36) = 2.78%

Ref:

Dice sum	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$

Table 2.5: Probability distribution for the sum of two dice.

2.12 **<u>School absences.</u>**

a) What is the probability that a student chosen at random doesn't miss any days of school due to sickness this year?

<u>No days missed</u>

25% = 1 day missed (given)

15% = 2 days missed (given)

28% = 3 days or more missed (given)

25%+15%+28% = 68% = % of students who missed 1 or more days

100%-68% = **32% of students did not miss a day**

b) What is the probability that a student chosen at random misses no more than one day?

32% = No days missed (*see: a*)

25% = 1 day missed (given)

32%+25% = **57% missed no more than one day**

c) What is the probability that a student chosen at random misses at least one day?

68% (*see: solution a*)

d) If a parent has two kids at a DeKalb County elementary school, what is the probability that neither kid will miss any school? Note any assumption you must make to answer this question.

32% of students do not miss a day (*see: solution a*)

P(A+B) = PA x PB

P(A+B) = 32% x 32% = **10.24%**

Assumption: Each child's probability of missing school is independent from one another

e) If a parent has two kids at a DeKalb County elementary school, what is the probability that both kids will miss some school, i.e. at least one day? Note any assumption you must make to answer this question.

P(A+B) = PA x PB

P(A+B) = 68% x 68% = **46.24%**

Assumption: Each child's probability of missing school is independent from one another

f) If you made an assumption in part (d) or (e), do you think it was reasonable? If you didn't make any assumptions, double check your earlier answers.

I believe that the independence of probability that each child will miss school is a reasonable assumption in that the probability that one event occurs (Child A misses/does not miss school) does not directly correlate with the probability that the other event (Child B misses/does not miss school).

2.18 **Health coverage, relative frequencies**

a) Are being in excellent health and having health coverage mutually exclusive?

No, they are not mutually exclusive because it is possible that Event 1 (being in excellent health) and Event 2 (having coverage) can both occur together. For example, it is possible that you can be in poor health, yet have coverage (.0289) and vice versa (.0230).

b) What is the probability that a randomly chosen individual has excellent health?

0.2329 – (Given via table)

c) What is the probability that a randomly chosen individual has excellent health given that he has health coverage?

0.2099 – (Given via table)

d) What is the probability that a randomly chosen individual has excellent health given that he doesn't have health coverage?

0.0230 – (Given via table)

e) Do having excellent health and having health coverage appear to be independent?

No, these two events do not appear to be independent as there is a strong correlation between health and coverage – if one looks at the probability of having excellent health and having coverage (0.2099) and being in excellent health and not having coverage (.0230), one can see that the healthier an individual is, the more likely it is that that individual has health coverage. As such, one can use this data to better predict a subject's health given his health coverage variable.

2.24 **Exit poll.**

Favor of Scott Walker = 53% (given)

Voted for Scott Walker, had college degree = 37% (given)

Voted against Scott Walker, had college degree = 44% (given)

Random sampled a person that had a college degree, what is the probability that he voted in favor of Scott Walker?

P(in favor of SW) = 53%	- P(college degree) = 37%	= 53%*37% = 19.61%
	- P(no college degree) = 1-37% = 63%	= 53%*63%= 33.39%
P(against SW) = 1-53% = 47%	- P(college degree) = 44%	= 47%*44% = 20.21%
	- P(no college degree) = 1-44% = 56%	= 47%*56% = 26.32%

P(In Favor|College Degree) = P(College Degree, voted for)/P(College Degree)

P(In Favor|College Degree) = 19.61%/(19.61% + 20.21%)

P(In Favor|College Degree) = **49.25%**

Note: While I showed the long calculation here using Bayes Theorem, I also completed this in RStudio, similar to our discussion question, and came to the same conclusion/tree diagram.

2.30 **Books on a bookshelf**

a) Find the probability of drawing a hardcover book first then a paperback fiction book second when drawing without replacement.

P(hardcover book) = 28/95

P(paperback fiction book) = 59/95

P(hardcover book first, then paperback fiction)

28/95*59/94 (note: remove one from denominator) = **18.5%**

b) Determine the probability of drawing a fiction book first and then a hardcover book second, when drawing without replacement.

P(fiction book) = 72/95

P(hardcover book) 28/95

P(fiction book first, then hardcover book)

72/95*28/94 (note: remove one from denominator) = **22.58%**

c) Calculate the probability of the scenario in part (b), except this time complete the calculations under the scenario where the first book is placed back on the bookcase before randomly drawing the second book.

72/95*28/95 (note: *replaced*, do not remove) = **22.34%**

d) The final answers to parts (b) and (c) are very similar. Explain why this is the case.

The answers are relatively similar because we are only selecting two consecutive books in a big population of books by comparison. The +/- of 1 book within the entire population of books (95) makes the impact of replacement very small.

2.36 **Is it worth it?**

a) Create a probability model and find Andy's expected profit per game.

		2-10	J-A	A	Ace of Clubs
A	Cost	\$2	\$2	\$2	\$2
B	Winning	\$0	\$3	\$5	\$25
C=B-A	Net	(\$2)	\$1	\$3	\$23
D	Available Cards	36	12	4	1
E	Cards in Deck	52	52	52	52
F=D/E	P(x)	69.23%	23.08%	7.69%	1.92%
G=F*C	Winnings	(\$1.38)	\$0.23	\$0.23	\$0.44
	Profit (loss) per turn				(\$0.48)

b) Would you recommend this game to Andy as a good way to make money? Explain.

No, I would not recommend this game to Andy as he will lose 48 cents per turn.

2.42 **Scooping ice cream.**

a) An entire box of ice cream, plus 3 scoops from a second box is served at a party. How much ice cream do you expect to have been served at this party? What is the standard deviation of the amount of ice cream served?

How much ice cream expected to be served: 48 oz. + (3*2 oz.) = **54 oz. of ice cream.**

Add variances = 1+ (.0625 * 3) = 1.1875^2 (sq. for SD) = **1.41 oz. standard deviation**

b) How much ice cream would you expect to be left in the box after scooping out one scoop of ice cream? That is, find the expected value of X − Y . What is the standard deviation of the amount left in the box?

Ice cream left in the box after one scoop? Var(X+Y1) = 1+.0625 [1 scoop – add variances] = **1.0625**^2 = **1.129 oz.**

c) Using the context of this exercise, explain why we add variances when we subtract one random variable from another.

We add variances when we subtract one another because any time a random event such as scooping ice cream out or in – adds or subtracts to the total ounces of ice cream – the variance, or, uncertainty, increases.