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COURSE CODE AND TITLE-QUANTITATIVE ANALYSIS OF POLITICAL DATA 1(POLI -210) B3-HOMEWORK.

QTN 22- A certain family has 6 children, consisting of 3 boys and 3 girls. Assuming that all birth orders are equally likely, what is the probability that the 3 eldest children are the 3 girls?

ANS - Given that the probability of the total children is 6, the probability of each child's birth is $\frac{1!}{6!}$

Hence the probability of the first eldest being girls is $\frac{3}{6}, \frac{2}{5}, \frac{1}{4}$

therefore, $\left(\frac{3}{6} \times \frac{2}{5} \times \frac{1}{4}\right) =$ 0.5 x 0.4 x 0.25 = 0.05

The probability of 3 eldest children are the 3 girls is 5%.

QTN 34 -A group of 30 dice are thrown. What is the probability that 5 of each of the values 1, 2, 3, 4, 5, 6 appear?

ANS – Given that the probability of having 5 appear 6 times =P(?) = $\frac{\text{No of favorable outcomes}}{\text{No of possible outcomes}}$

WORKINGS: Dice 6 = (30/5) =30! /25! 5

Dice 5 = (25/5) =25! /20!5

Dice 4 = (20/5) = 20! /15!5!

Dice 3 = (15/5) =15! /10!5!

Dice 2 = (10/5) = 10! /5!5!

Dice 1 = (5/5) =1

$$= \frac{30!\ 25!\ 20!\ 15!\ 10!}{25!5!20!15!5!10!5!}$$

Where repetitive numbers in the numerator cancels out same in the denominator-

Hence,

$$= \frac{30! / (5!)^6}{6^{30}} = 0.0004 \text{ or } 0.04\%$$

The probability that 5 of each of the values 1, 2, 3, 4, 5, 6 appear = 0.04%

Chapter 2 problems (2.11 exercises)

Qtn 2 A woman is pregnant with twin boys. Twins may be either identical or fraternal (non-identical). In general, 1/3 of twins born are identical. Obviously, identical twins must be of the same sex; fraternal twins may or may not be. Assume that identical twins are equally likely to be both boys or both girls, while for fraternal twins all possibilities are equally likely. Given the above information, what is the probability that the woman's twins are identical?

Ans: Using the Baye's formula- $P(\text{identical}|BB) = \frac{P(BB|\text{identical})\ P(\text{identical})}{P(BB)}$ Lets plug in the numbers-

$$P(\text{ident I 2 boys}) = \frac{P(\text{2 boys I ident}).\ P(\text{ident})}{P(\text{2 boys})}$$

$$\frac{\frac{1}{2}.\frac{1}{3}}{1/3.\ \frac{1}{2} + 2/3.\ \frac{1}{4}}$$

$$= \frac{1/6}{1/6 + 2/12} = \frac{1/6}{1/6 + 1/6} = \frac{1/6}{2/6} = \frac{1}{2}$$

$=\frac{1}{2}$

Therefore, the probability that the woman's twins are identical is ½ or half which is 50%.

32. Consider four nonstandard dice (the Efron dice), whose sides are labeled as follows (the 6 sides on each die are equally likely). A: 4, 4, 4, 4, 0, 0 B: 3, 3, 3, 3, 3, 3 C: 6, 6, 2, 2, 2, 2 D: 5, 5, 5, 1, 1, 1 These four dice are each rolled once. Let A be the result for die A, B be the result for die B, etc. (a) Find P(A>B), P(B>C), P(C>D), and P(D>A). (b) Is the event A>B independent of the event B>C? Is the event B>C independent of the event C>D? Explain.

ANS- Given that; A: 4, 4, 4, 4, 0, 0 C: 6, 6, 2, 2, 2, 2 D: 5, 5, 5, 1, 1, 1

B: 3, 3, 3, 3, 3, 3

A) The probability that A is greater than B(A>B) =P (A =4) =4/6 = 2/3

P (B >C) = P (C = 2) = 4/6 = 2/3

P (C > D) = P (C =6) + P (C = 2 n D = 1) = 2/6 + 4/6 x 3/6 = 2/6 + 12/36 = 2/3

P (D > A) = P (D =5) + P (D = 5) + P (D = 1 n A = 0) = 5/6 + 3/6 x 2/6 = 3/6 + 6/36 = 4/6 = 2/3

32B) Yes, Given the event that A > B, the probability takes the value of B, this is seen in that only B has the value 3. Therefore, P(A>B) is the same as P (A =4), which is independent of B. Hence, A > B, B > C are neither joint nor mutually exclusive but Independent.

No. Conversely, given the event that B > C, this implies the effect of the value of D. The probability of C>D will indicate a higher result of C = 6. As it maintains a high probability that C = 6, hence B > C results in a much lower probability. therefore, the Independence of events –B >C and C> D.

Qtn 38) Consider the following 7-door version of the Monty Hall problem. There are 7 doors, behind one of which there is a car (which you want), and behind the rest of which there are goats (which you don't want). Initially, all possibilities are equally likely for where the car is. You choose a door. Monty Hall then opens 3 goat doors, and offers you the option of switching to any of the remaining 3 doors. Assume that Monty Hall knows which door has the car, will always open 3 goat doors and offer the option of switching, and that Monty chooses with equal probabilities from all his choices of which goat doors to open. Should you switch? What is your probability of success if you switch to one of the remaining 3 doors?

ANS- The probability of switching doors is never overemphasized, this is mainly because you stand more chances of winning when you do compared to when you don't. The initial probability of getting the car was 1/7 post the 3 goats' door was opened, the 3 unopened doors have a 2/7 chance or probability because the car is behind one of each. Sticking to the initial plan would yield a probability of 1/7 while switching doors yields better chances of 2/7. Hence you should switch!