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S M T W T F S

Notes: Probability Assignment

Q1 A bag contains fifteen balls distinguishable only by their colours; ten are blue & five are red. I reach into the bag with both hands & pull out two balls (one with each hand) & record their colours.

Ans 1) What are random phenomenon?  
The selection of two balls with each hand

2) What is sample space?  
Ans Sample space =  $\{(Red, Blue), (Blue, Red), (Red, Red), (Blue, Blue)\}$

3) Express the event that ball in my left hand is red as a subset of sample space?  
Ans ~~Consider~~ Consider the event be in form (Left, Right),  $\{(Red, Blue), (Red, Red)\}$

Q2 Three unbiased coins are tossed. What is the probability of getting at most two heads?

$SS = \{(H, H, H), (H, H, T), (H, T, H), (T, H, H), (T, T, H), (T, H, T), (H, T, T), (T, T, T)\}$

$n(SS) = 8$

Only one element contains more than 2 heads.  
 $n(A) = 1$

Hence Prob =  $\frac{1}{8}$



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Q3 Throw two dice. A & B are defined below  $A = \{\text{max is } 2\}$ ,  $B = \{\text{min is } 2\}$ . Are A & B independent. ~~Ans~~  
 Ans For events to be independent, they must be mutually exclusive.

For A  $\Rightarrow$  max ~~value~~ value to be 2  
 $\Rightarrow \{(1, 2), (2, 1), \underline{(2, 2)}, (1, 1)\}$   
 & in B  $\Rightarrow$  min value to be 2  
 $\Rightarrow \{\underline{(2, 2)}, (2, 3), \dots\}$

~~subcase~~ In this case the event  $(2, 2)$  is inclusive between both events hence they are not independent.

4) You call 2 Uber & 3 Ola cars. If <sup>the</sup> time that each takes to reach you is IID, what is probability that Uber arrives first?

Ans, Time taken to reach is same,  $n(s) = 2 + 3 = 5$   
 so probability that Uber ~~drives~~ arrives first is

$$\frac{n(u)}{n(s)} \Rightarrow \frac{2}{5}$$

5) Soln,  $P(\text{spam}) = 0.3$   
 $P(\text{use}) = 0.7$   
 $P(\text{offer} | \text{spam}) = \cancel{0.3} \times 0.8$   
 $P(\text{offer} | \text{use}) = 0.1$

$$P(\text{offer}) = P(\text{offer} | \text{spam}) \times P(\text{spam}) + P(\text{offer} | \text{use}) \times P(\text{use})$$

$$= 0.8 \times 0.3 + 0.7 \times 0.1$$



$$= 0.24 + 0.07$$

$$P(\text{offer}) \Rightarrow 0.31$$

prob that new mail is spam

$$\Rightarrow P(\text{spam} / \text{offer})$$

$$\Rightarrow \frac{P(\text{offer} / \text{spam}) \times P(\text{spam})}{P(\text{offer})}$$

$$\Rightarrow \frac{0.9 \times 0.3}{0.31}$$

$$\Rightarrow \frac{0.27}{0.31} \approx 0.87$$

$$\Rightarrow 0.8$$

Q6

$$P(N.S) = 0.9$$

$$P(C / N.S) = 0.95$$

$$P(S) = 0.1$$

if label 50% incorrectly means it'll correctly label 50%

$$P(C / S) = 0.5$$

To find,

$$P(N.S / C) \Rightarrow \frac{P(C / N.S) \times P(N.S)}{P(C)}$$

$$P(C) = P(C / N.S) \times P(N.S) + P(C / S) \times P(S)$$

$$= 0.95 \times 0.9 + 0.5 \times 0.1$$



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Notes: \_\_\_\_\_

Azure ML ,

Prob,

Dashboard.

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$$P(C) \Rightarrow 0.855 + 0.05$$

$$\Rightarrow 0.9$$

$$\Rightarrow \frac{0.95 \times 0.9}{0.9}$$

$$\Rightarrow \frac{0.855}{0.9} \Rightarrow \cancel{0.95} 0.95$$

Q7 Binomial  $\Rightarrow {}^nC_k P(A)^k \cdot (1-P(A))^{n-k}$   
Probability

$$n=5, k=2$$

$${}^5C_2 \Rightarrow \frac{5!}{2!(5-2)!} \Rightarrow \frac{5 \times 4}{2} \Rightarrow 10$$

$$P(A) = 0.38$$

$$10 \times (0.38)^2 \times (1-0.38)^{5-2}$$

$$\Rightarrow 10 \times 0.38 \times 0.38 \times (0.62)^3$$

$$\Rightarrow 1.44 \times 0.238$$

$$\Rightarrow \cancel{0.344} 0.344$$

Q8)