EEL3850 HW01 JPearson

Q1 $\{Q, F, P\}$ $A \in F$, $B \in F$ $C \in F$

$P(A) = 0.5$, $P(B) = 0.2$ $P(C) = 0.1$

$P(\overline{A \cup B}) = 0.45$

* $P(\overline{A \cup B}) = P(\bar{A} \cap \bar{B}) = P(\bar{A}) + P(\bar{B})$

1) $P(A \cup B) = P(\Omega) - P(\overline{A \cup B})$

$1 - 0.45$

$P(A \cup B) = 0.55$

2) $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= 0.5 + 0.2 - 0.55$

$P(A \cap B) = 0.15$

3) $P(A \cap \bar{B}) = P(A) - P(A \cap B)$

$= 0.5 - 0.15$

$P(A \cap \bar{B}) = 0.35$

4 No, they are not exclusive $P(A \cap B) \neq 0$ so they contain a region that is shared in the space.

Q2 $P(A) = 1/6$ A: (Rolling a four)

1) $P(E_4) = P(A) + P(A) + P(A) + P(A)$
$= 4/6$

Probability of rolling one 4 in four rolls

2) $P(E_{20}) = 20\ P(A) = \frac{20}{6}$

$1 - (P(A))^n$
$P(E) = \cancel{(1)} - (P(A))^n$
$=$

3) $0.9 = (1) - (\frac{1}{6})^n$
$\cancel{0.9} = (\frac{5}{6})^n$
$0.1 = (\frac{5}{6})^n$

$n = \frac{\cancel{\log(\frac{5}{6})}}{\cancel{\log(\frac{1}{10})}} \quad \frac{\log(\frac{1}{10})}{\log(\frac{5}{6})} = \frac{\cancel{\log(1)}}{\cancel{\log(10)}} \cdot \quad \cancel{\log(1) - \log(10) - \log(5) - \log(6)}$

$n = \frac{\log(1) - \log(10)}{\log(5) - \log(6)} = \frac{0 - 1}{0.69 - 0.77} = -12.5$

$n = 13$ rolls

Q3 $P(\text{Even}) = 2P(\text{odd})$

$P(\text{Even}) = 2P(\text{odd})$ 6 sides $P(\Omega) = 1$

$\Omega \to \{1, 2, 3, 4, 5, 6\}$ $P(1) = P(3) = P(5)$

$P(2) = P(4) = P(6)$

$P(1) = \frac{1}{2} P(2)$

$P(\Omega) = 1$

$1 = P(1) + 2P(1) + 1P(1) + 2P(1) + 1P(1) + 2(P(1))$

$P(1) = 1/9$

$P(2) = 2/9$

Equal for all evens or odds

$P(E < 4) = P(1) + P(2) + P(3) = \frac{1}{9} + \frac{2}{9} + \frac{1}{9} = \underline{4/9}$

Q4 10 books, without replacement, without ordering

→ Combination

1) ${}_{10}C_3 = 120$

Prob & Stats ${}_3C_1 = 3$ $3 \times 2 \times 3 = 18$

Lin alg ${}_2C_1 = 2$

Culinary ${}_3C_1 = 3$

2) $P(E) = \frac{18}{120} = \frac{\cancel{9}}{\cancel{60}} = \frac{\cancel{3}}{\cancel{20}} = \frac{3}{20}$

Q5 $P_A = 0.002$

$P_B = 0.02$

$P_C = 0.001$

1) $P(E) = \frac{P(A) + P(B) + P(C)}{3} = \frac{0.023}{3} \approx 0.0076$

2) $P(E_A) = \frac{P(A)}{P(A) + P(B) + P(C)} = 0.0869$

$P(E_B) = \frac{P(B)}{P(A) + P(B) + P(C)} = 0.869$

$P(E_C) = \frac{P(C)}{P(A) + P(B) + P(C)} = 00434$

$P(E_A) + P(E_B) + P(E_C) \simeq 1$

3) $\cancel{P_A = 0.002}$ x

Q6 52 cards

1) 4 aces, $P(E_{ace}) = \frac{4}{52} = \frac{2}{26} = \underline{\frac{1}{13}}$

2) Jack of Spade $P(E_{JS}) = 1/52$

3) $P(E_{JS}) + P(E_{SD}) = 1/52 + 1/52 = 2/52 = 1/26$

4) $P(\overline{E_S}) + P(\overline{E_H}) = \frac{1}{2}$

Q7 $P(H_i) = \frac{13}{52}(i)$

$P(H_i) = \frac{13i}{52}$ $P(H_1) = \frac{13}{52}$

$P(H_2) = \frac{13}{51} \cdot \frac{(51-13)}{51}$