



SECI 2143-01
PROBABILITY & STATISTICAL DATA ANALYSIS

ASSIGNMENT 2

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Question 1

Question 1

Let,

very easy = A

easy = B

average = C

difficult = D

very difficult = E

$$P(A) = 0.08, P(B) = 0.29, P(C) = 0.34, P(D) = 0.17, P(E) = 0.12$$

$$\begin{aligned} \text{a) } P(C \cup B \cup A) &= P(C) + P(B) + P(A) - P(C \cap B \cap A) \\ &= 0.34 + 0.29 + 0.08 - 0 \\ &= 0.71 \end{aligned}$$

$$\begin{aligned} \text{b) } P(C \cup D \cup E) &= P(C) + P(D) + P(E) - P(C \cap D \cap E) \\ &= 0.34 + 0.17 + 0.12 - 0 \\ &= 0.63 \end{aligned}$$

$$\text{c) } P(E' \cap A') = 1 - P(E \cup A)$$

$$\begin{aligned} \text{c) } P(E' \cap A') &= 1 - P(E \cup A) \\ &= 1 - (0.12 + 0.08) \\ &= 0.80 \end{aligned}$$

$$\begin{aligned} \text{d) } P(D \cup A) &= P(D) + P(A) - P(D \cap A) \\ &= 0.17 + 0.08 - 0 \\ &= 0.25 \end{aligned}$$

Question 2

Question 2

$$P(A) = 0.60, P(B) = 0.30, P(A \cup B) = 0.80$$

a) $P(A \cap B)$

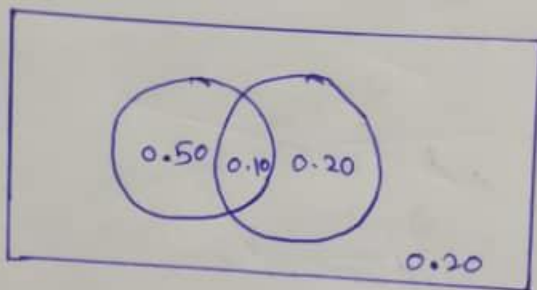
$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$0.80 = 0.60 + 0.30 - P(A \cap B)$$

$$P(A \cap B) = 0.60 + 0.30 - 0.80$$

$$P(A \cap B) = 0.10$$

b)



c) $P(A' \cap B) = P(B) - P(A \cap B)$

$$= 0.30 - 0.10$$

$$= 0.20$$

d) $P(A' \cap B') = 1 - P(A \cup B)$

$$= 1 - 0.80$$

$$= 0.20$$

e) $P(A' \cup B') = 1 - P(A \cap B)$

$$= 1 - 0.10$$

$$= 0.90$$

f) $P(A \cap B') = P(A) - P(A \cap B)$

$$= 0.60 - 0.10$$

$$= 0.50$$

Question 3

Question 3

Let,

Package A = A

Package B = B

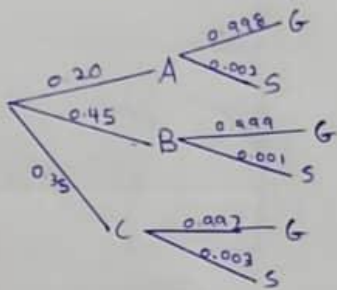
Package C = C

Good Service = G

Bad Service = S

$$P(A) = 0.20, P(B) = 0.45, P(C) = 0.35$$

a) Tree diagram



$$\begin{aligned} \text{b) } P(\text{Customer experienced with a good service from the airlines}) &= P(A \cap G) + P(B \cap G) + P(C \cap G) \\ &= (0.20 \times 0.998) + (0.45 \times 0.999) + (0.35 \times 0.997) \\ &= 0.9981 \end{aligned}$$

$$\begin{aligned} \text{c) } P(B|S) &= \frac{P(B \cap S)}{P(S)} \\ &= \frac{P(B) \cdot P(S|B)}{P(S)} \end{aligned}$$

c) Let,

package is operating smoothly = O

$$P(O) = 0.9981$$

$$\begin{aligned} P(B|O) &= \frac{P(B \cap O)}{P(O)} \\ &= \frac{P(B) \cdot P(O|B)}{P(O)} \\ &= \frac{0.45 \times 0.999}{0.9981} \\ &= 0.4504 \end{aligned}$$

Question 4

a) X is a binomial random variable

$$b) P(X=8) = b(8, 20, 0.7)$$

$$= {}^{20}C_8 (0.7)^8 (0.3)^{12}$$

$$= 0.0039$$

$$c) P(7 \leq X \leq 10) = P(X=7) + P(X=8) + P(X=9) + P(X=10)$$

$$= b(7, 20, 0.7) + b(8, 20, 0.7) + b(9, 20, 0.7) + b(10, 20, 0.7)$$

$$= {}^{20}C_7 (0.7)^7 (0.3)^{13} + {}^{20}C_8 (0.7)^8 (0.3)^{12} + {}^{20}C_9 (0.7)^9 (0.3)^{11} +$$

$${}^{20}C_{10} (0.7)^{10} (0.3)^{10}$$

$$= 0.0010 + 0.0039 + 0.012 + 0.0308$$

$$= 0.0477$$

$$d) P(3 \leq X \leq 5) = P(X=3) + P(X=4) + P(X=5)$$

$$= b(3, 20, 0.3) + b(4, 20, 0.3) + b(5, 20, 0.3)$$

$$= {}^{20}C_3 (0.3)^3 (0.7)^{17} + {}^{20}C_4 (0.3)^4 (0.7)^{16} + {}^{20}C_5 (0.3)^5 (0.7)^{15}$$

$$= 0.0716 + 0.1304 + 0.1789$$

$$= 0.3809$$

Question 5

$$a) P(X=3) = b(3, 1, 0.7)$$

$$= {}^{3-1}C_{1-1} (0.7)^1 (0.3)^2$$

$$= {}^2C_0 (0.7)^1 (0.3)^2$$

$$= 0.063$$

$$b) P(X < 4) = P(X=1) + P(X=2) + P(X=3)$$

$$= b(1, 1, 0.7) + b(2, 1, 0.7) + b(3, 1, 0.7)$$

$$= {}^{1-1}C_{1-1} (0.7)^1 (0.3)^0 + {}^{2-1}C_{1-1} (0.7)^1 (0.3)^1 + {}^{3-1}C_{1-1} (0.7)^1 (0.3)^2$$

$$= {}^0C_0 (0.7)^1 (0.3)^0 + {}^1C_0 (0.7)^1 (0.3)^1 + {}^2C_0 (0.7)^1 (0.3)^2$$

$$= 0.7 + 0.21 + 0.063$$

$$= 0.973$$

$$c) P(X=5) = b(7, 5, 0.7)$$

$$= {}^{7-1}C_{5-1} (0.7)^5 (0.3)^2$$

$$= {}^6C_4 (0.7)^5 (0.3)^2$$

$$= 0.2269$$

$$b) \text{Mean} = np$$

$$= 5(0.7)$$

$$= 3.5$$

$$\text{Variance} = npq$$

$$= 5(0.7)(0.3)$$

$$= 1.05$$

$$n = 5$$

$$p = 0.7$$

$$q = 0.3$$

Question 6

$$X \sim N(36, 0.1^2)$$

Let Y = bag of sugar that out of control

$$a) P(Y) = P(X < 35.8) + P(X > 36.2)$$

$$= P\left[Z < \frac{35.8 - 36}{0.1}\right] + P\left[Z > \frac{36.2 - 36}{0.1}\right]$$

$$P = (Z < -2) + P(Z > 2)$$

$$= 2[1 - P(Z < 2)]$$

$$= 2(1 - 0.9772)$$

$$= 2(0.0228)$$

$$= 0.0456$$

$$b) Y \sim B(0, 16, 0.0456)$$

$$P(Y=0) = B(0; 16, 0.0456)$$

$$= {}^{16}C_0 (0.0456)^0 (0.9544)^{16}$$

$$= 0.4739$$

$$(c) P(Y=1) = B(1; 16, 0.0456)$$

$$= {}^{16}C_1 (0.0456)^1 (0.9544)^{15}$$

$$= 0.3623$$

$$(d) P(Y) = P(X < 35.8) + P(X > 36.2)$$

$$P\left[Z < \frac{35.8 - 37}{0.4}\right] + P\left[Z > \frac{36.2 - 37}{0.4}\right]$$

$$= P(Z < -3) + P(Z > -2)$$

$$= [1 - P(Z < 3)] + P(Z < 2)$$

$$= (1 - 0.9987) + 0.9772$$

$$= 0.0013 + 0.9772$$

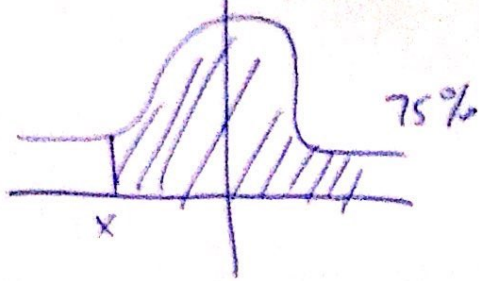
$$= 0.9785$$

Question 7

$$\begin{aligned} \text{a) } P(20 < x < 40) &= P\left[\frac{20-28}{8} < z < \frac{40-28}{8}\right] \\ &= P(-1 < z < 1.5) \\ &= P(z < 1.5) - P(z < -1) \\ &= P(z < 1.5) - [1 - P(z < 1)] \\ &= 0.9332 - (1 - 0.8413) \\ &= 0.9332 - 0.1587 \\ &= 0.7745 \end{aligned}$$

$$\begin{aligned} \text{b) } P(x < 30) &= P\left(z < \frac{30-28}{8}\right) \\ &= P(z < 0.25) \\ &= 0.5987 \end{aligned}$$

c)



$$P(X > x) = 0.75$$

$$P\left(Z > \frac{x - 28}{8}\right) = 0.75$$

$$P\left(Z < \frac{28 - x}{8}\right) = 0.75$$

$$\frac{28 - x}{8} = 0.674$$

$$28 - x = 5.392$$

$$x = 22.608$$

$$x \approx 23 \text{ day}$$