



SECI2143-01 KEBARANGKALIAN STATISTIK DAN ANALISIS DATA

(PROBABILITY & STATISTICAL DATA
ANALYSIS)

ASSIGNMENT 2

DR SHARIN

DONE BY:

PHANG CHENG YI (A20EC0131)

SHAHRLIL BIN SAIFUL BAHRI (A20EC0144)

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PSDA Assignment 2

Question 1

Given

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

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

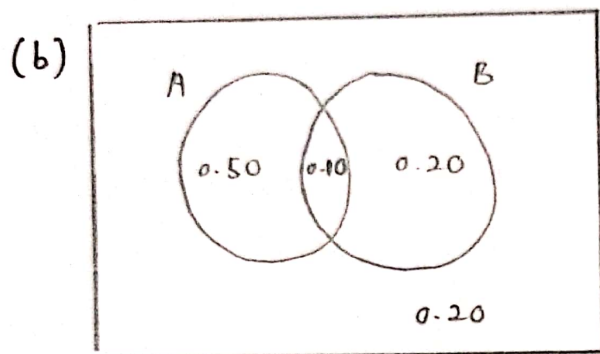
$$\begin{aligned} (b) \quad P(C \cup D \cup E) &= P(C) + P(D) + P(E) \\ &= 0.34 + 0.17 + 0.12 \\ &= 0.63 \end{aligned}$$

$$\begin{aligned} (c) \quad P(A \cup E)' &= 1 - P(A \cup E) \\ &= 1 - (P(A) + P(E)) \\ &= 1 - (0.08 + 0.12) \\ &= 1 - 0.20 \\ &= 0.80 \end{aligned}$$

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

Question 2

$$\begin{aligned}
 (a) \quad P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\
 0.80 &= 0.60 + 0.30 - P(A \cap B) \\
 P(A \cap B) &= 0.60 + 0.30 - 0.80 \\
 &= 0.10
 \end{aligned}$$



$$\begin{aligned}
 1 - P(A \cup B) &= 1 - 0.80 \\
 &= 0.20
 \end{aligned}$$

$$\begin{aligned}
 P(A' \cap B) &= P(B) - P(A \cap B) \\
 &= 0.30 - 0.10 \\
 &= 0.20
 \end{aligned}$$

$$\begin{aligned}
 P(A \cap B') &= P(A) - P(A \cap B) \\
 &= 0.60 - 0.10 \\
 &= 0.50
 \end{aligned}$$

$$\begin{aligned}
 (c) \quad P(A' \cap B) &= P(B) - P(A \cap B) \\
 &= 0.30 - 0.10 \\
 &= 0.20
 \end{aligned}$$

$$\begin{aligned}
 (d) \quad P(A' \cap B') &= P(A \cup B)' \\
 &= 1 - P(A \cup B) \\
 &= 1 - 0.80 \\
 &= 0.20
 \end{aligned}$$

$$\begin{aligned}
 (e) \quad P(A' \cup B') &= P(A \cap B)' \\
 &= 1 - P(A \cap B) \\
 &= 1 - 0.10 \\
 &= 0.90
 \end{aligned}$$

$$\begin{aligned}
 (f) \quad P(A \cap B') &= P(A) - P(A \cap B) \\
 &= 0.60 - 0.10 \\
 &= 0.50
 \end{aligned}$$

Question 3

Let

A = Package A

B = Package B

C = Package C

S = Bad services

S' = Not bad services

Given

$$P(A) = 0.20$$

$$P(B) = 0.45$$

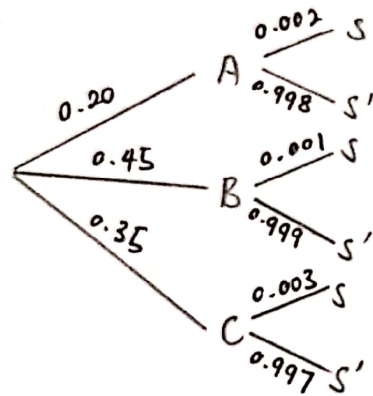
$$P(C) = 0.35$$

$$P(S|A) = 0.002$$

$$P(S|B) = 0.001$$

$$P(S|C) = 0.003$$

(a)



$$\begin{aligned} (b) \quad P(S') &= P(A)P(S') + P(B)P(S') + P(C)P(S') \\ &= 0.20(0.998) + 0.45(0.999) + 0.35(0.997) \\ &= 0.9981 \end{aligned}$$

$$\begin{aligned} (c) \quad P(B|S') &= \frac{P(B \cap S')}{P(S')} \\ &= \frac{P(B)P(S'|B)}{P(S')} \\ &= \frac{0.45(0.999)}{0.9981} \\ &= 0.4504 \end{aligned}$$

Question 4

(a) X is a binomial random variable.

(b) $n=20$, $p=0.70$

$$\begin{aligned}P(X=8) &= b(8; 20, 0.7) \\&= \binom{20}{8} (0.7)^8 (0.3)^{12} \\&= 0.003859\end{aligned}$$

(c) $n=20$, $p=0.70$

$$\begin{aligned}P(7 \leq X \leq 10) &= P(X=7) + P(X=8) + P(X=9) + P(X=10) \\&= b(7; 20, 0.7) + b(8; 20, 0.7) + b(9; 20, 0.7) + b(10; 20, 0.7) \\&= \binom{20}{7} (0.7)^7 (0.3)^{13} + \binom{20}{8} (0.7)^8 (0.3)^{12} + \binom{20}{9} (0.7)^9 (0.3)^{11} + \binom{20}{10} (0.7)^{10} (0.3)^{10} \\&= 0.001018 + 0.003859 + 0.012007 + 0.030817 \\&= 0.047701\end{aligned}$$

(d) $n=20$, $p=0.3$

$$\begin{aligned}P(3 \leq X \leq 5) &= P(X=3) + P(X=4) + P(X=5) \\&= b(3; 20, 0.3) + b(4; 20, 0.3) + b(5; 20, 0.3) \\&= \binom{20}{3} (0.3)^3 (0.7)^{17} + \binom{20}{4} (0.3)^4 (0.7)^{16} + \binom{20}{5} (0.3)^5 (0.7)^{15} \\&= 0.071604 + 0.130421 + 0.178863 \\&= 0.380888\end{aligned}$$

Question 5

$$(a)(i) \quad P(X=3) = (1-0.7)^{3-1} (0.7) \\ = 0.063$$

$$(ii) \quad P(X < 4) = P(X=1) + P(X=2) + P(X=3) \\ = (1-0.7)^{1-1} (0.7) + (1-0.7)^{2-1} (0.7) + (1-0.7)^{3-1} (0.7) \\ = 0.7 + 0.21 + 0.063 \\ = 0.973$$

$$(iii) \quad P(X=5) = {}^n C_r (p)^r (q)^{n-r} \\ = {}^{7-1} C_{5-1} (0.7)^5 (0.3)^2 \\ = 0.2269$$

$$(b) \quad n=5, \quad p=0.7, \quad q=0.3$$

$$\text{mean, } \mu = np \\ = 5(0.7) \\ = 3.5$$

$$\text{Variance, } \sigma^2 = npq \\ = 5(0.7)(0.3) \\ = 1.05$$

Question 6

$$(a) \quad X \sim N(36, 0.1)$$

$$\begin{aligned} & P(X < 35.8) + P(X > 36.2) \\ &= P\left(Z < \frac{35.8 - 36}{0.1}\right) + P\left(Z > \frac{36.2 - 36}{0.1}\right) \\ &= P(Z < -2) + P(Z > 2) \\ &= 0.0228 + (1 - 0.9772) \\ &= 0.0228 + 0.0228 \\ &= 0.0456 \end{aligned}$$

$$(b) \quad n = 16, \quad p = 0.0456$$

$$\begin{aligned} P(X = 0) &= b(0; 16, 0.0456) \\ &= \binom{16}{0} (0.0456)^0 (0.9544)^{16} \\ &= 0.4739 \end{aligned}$$

$$\begin{aligned} (c) \quad P(X = 1) &= b(1; 16, 0.0456) \\ &= \binom{16}{1} (0.0456)^1 (0.9544)^{15} \\ &= 0.3623 \end{aligned}$$

$$(d) \quad X \sim N(37, 0.4)$$

$$\begin{aligned} & P(X < 35.8) + P(X > 36.2) \\ &= P\left(Z < \frac{35.8 - 37}{0.4}\right) + P\left(Z > \frac{36.2 - 37}{0.4}\right) \\ &= P(Z < -3) + P(Z > -2) \\ &= 0.0013 + (1 - 0.0228) \\ &= 0.0013 + 0.9772 \\ &= 0.9785 \end{aligned}$$

Question 7

$$(a) \quad X \sim N(28, 8)$$

$$\begin{aligned} P(20 \leq X \leq 40) &= P\left(\frac{20-28}{8} \leq Z \leq \frac{40-28}{8}\right) \\ &= P(-1 \leq Z \leq 1.5) \\ &= 0.9332 - 0.1387 \\ &= 0.7745 \end{aligned}$$

$$\begin{aligned} (b) \quad P(X < 30) &= P\left(Z < \frac{30-28}{8}\right) \\ &= P(Z < 0.25) \\ &= 0.5987 \end{aligned}$$

$$(c) \quad P(X > a) = 0.75$$

$$1 - P(X \leq a) = 0.75$$

$$P(X \leq a) = 0.25$$

$$P\left(Z \leq \frac{a-28}{8}\right) = 0.25$$

$$P(Z \leq -0.67) = 0.25$$

$$\frac{a-28}{8} = -0.67$$

$$a = 8(-0.67) + 28$$

$$= 22.64$$

$$\approx 23 \text{ days}$$