



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

**PROBABILITY & STATISTICAL DATA
ANALYSIS**

SEMESTER II 2020/2021

SECI2143-05

ASSIGNMENT 2

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Question 1

$$\begin{aligned} \text{a) } P(A) &= 0.08 & P(B) &= 0.29 & P(C) &= 0.34 \\ & \text{(v. easy)} & & \text{(easy)} & & \text{(average)} \end{aligned}$$

$$\begin{aligned} P(D) &= 0.17 & P(E) &= 0.12 \\ & \text{(difficult)} & & \text{(very difficult)} \end{aligned}$$

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

$\therefore$ Probability for average, easy & very easy = 0.71

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

$\therefore$ Probability for average, difficult & very difficult = 0.63

$$\begin{aligned} \text{c) Find } P(A' \cup E') &= 1 - (P(A) + P(E)) \\ &= 1 - (0.08 + 0.12) \\ &= 1 - 0.2 \\ &= 0.8 \end{aligned}$$

$\therefore$ Probability for neither very difficult nor very easy = 0.8

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

$\therefore$ Probability for difficult or very easy = 0.25

Question 2.

a) $P(A \cap B)$

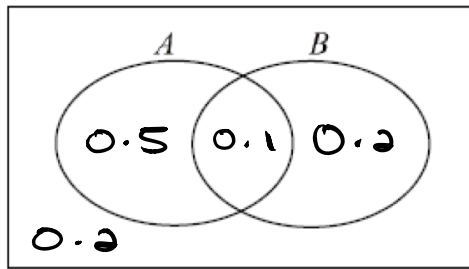
$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$0.8 = 0.6 + 0.3 - P(A \cap B)$$

$$P(A \cap B) = 0.6 + 0.3 - 0.8$$

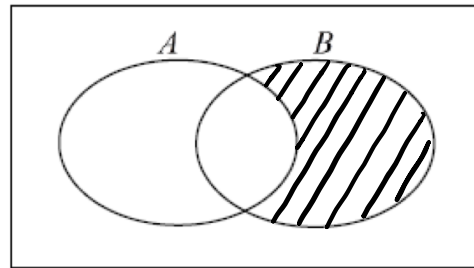
$$P(A \cap B) = 0.1$$

b)



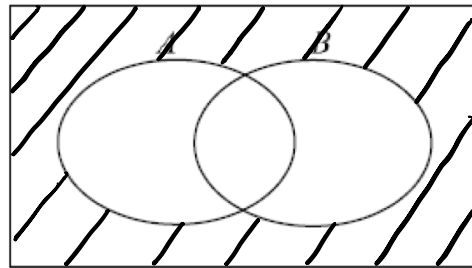
c) $P(A' \cap B) =$

$$= 0.2$$



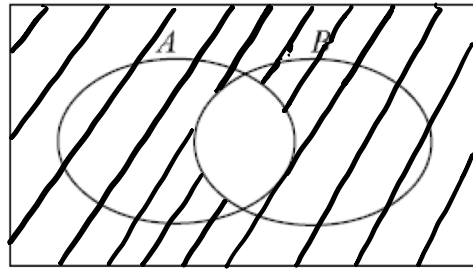
d) $P(A' \cap B') =$

$$= 0.2$$



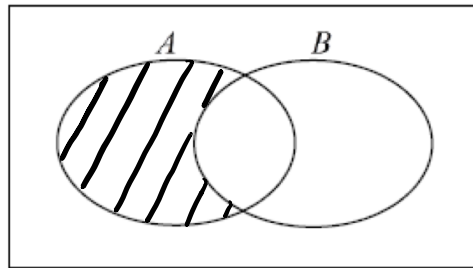
$$e) P(A' \cup B') =$$

$$= 0.9$$



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

$$= 0.5$$



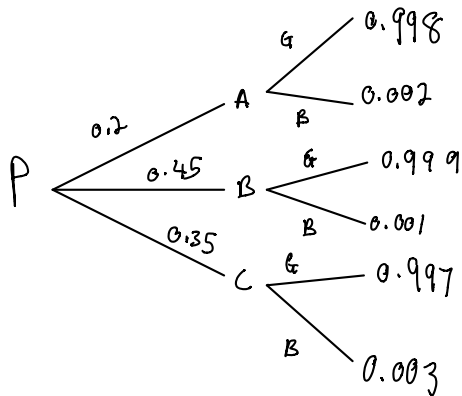
Question 3

Package A = 20% = 0.2
Package B = 45% = 0.45
Package C = 35% = 0.35

bad services

$$P(A) = 0.002, P(B) = 0.001, P(C) = 0.003$$

a) Good service = G
Bad service = B



b) Probability a customer had good service from the airline

let good service = G

$$P(G) = P(A)_G + P(B)_G + P(C)_G$$

referring from a):

$$\begin{aligned} P(G) &= 0.2(0.998) + 0.45(0.999) + 0.35(0.997) \\ &= 0.1996 + 0.44955 + 0.34895 \\ P(G) &= 0.9981 \end{aligned}$$

c) Package is operating smoothly, probability in Package B?

smoothly = good service (G)

$$\begin{aligned} P(B)_G &= 0.45(0.999) \\ &= 0.44955 \end{aligned}$$

$$\begin{aligned} P(\text{smoothly in B}) &= \frac{P(B)_G}{P(G)} \\ &= \frac{0.44955}{0.9981} \\ &= 0.4504 \end{aligned}$$

QUESTION 4

0.70 = dairy banana

0.30 = kurma

X = no. of dairy product purchased
among these 20 customers.

a) Binomial random variable.

b) $p = 0.70$, $q = 0.30$

$$\begin{aligned} & b(8; 20; 0.70) + \cancel{b(12; 20; 0.30)} \\ &= 20C8 \times (0.70)^8 \times (0.30)^{12} \\ &= 0.00386 \end{aligned}$$

$$\begin{aligned} c) & b(7; 20; 0.70) + b(8; 20; 0.70) + b(9; 20; 0.70) + b(10; 20; 0.70) \\ &= \left[20C7 \times (0.70)^7 \times (0.30)^{13} \right] + 0.00386 + \left[20C9 \times (0.70)^9 \times (0.30)^{11} \right] \\ &\quad + \left[20C10 \times (0.70)^{10} \times (0.30)^{10} \right] \\ &= 0.0477 \end{aligned}$$

$$\begin{aligned} d) & b(3; 20; 0.30) + b(4; 20; 0.30) + b(5; 20; 0.30) \\ &= \left[20C3 \times (0.30)^3 \times (0.70)^{17} \right] + \left[20C4 \times (0.30)^4 \times (0.70)^{16} \right] + \\ &\quad \left[20C5 \times (0.30)^5 \times (0.70)^{15} \right] \\ &= 0.381 \end{aligned}$$

Question 5

student pilot passes test = $P(T)$

$$P(T) = 0.7$$

a) i) passes test on third try

$$p, \text{ success} = 0.7$$

$$q, \text{ fail} = 1 - 0.7 = 0.3$$

$$x = 3 \text{ (third try)}, n = 1, P(X=3)$$

negative Binomial $\rightarrow b^*(x; n, p)$

$$b^*(3; 1, 0.7) = \binom{3-1}{1-1} (0.7)^1 (0.3)^{3-1}$$

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

$$= 0.063$$

ii) Passes before 4th try

$$P(X < 4), k=1, P=0.7, q=0.3$$

$$b^*(3, 1, 0.7) + b^*(2, 1, 0.7) + b^*(1, 1, 0.7)$$

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

$$= 0.063 + 0.21 + 0.7$$

$$= 0.973$$

iii) Pass at the fifth after seventh try

$$P(X=12) \quad p=0.7, q=0.3$$

$$= b^*(12; 1, 0.7)$$

$$= \binom{12-1}{1-1} (0.7)^1 (0.3)^{11} = {}^{11}C_0 (0.7)^1 (0.3)^{11} = 1.240 \times 10^{-6}$$

b) $n=5, p=0.7, q=0.3$

$$\text{mean} = np$$

$$= 5(0.7)$$

$$= 3.5$$

$$\text{variance} = npq$$

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

$$= 1.05$$

Question 6.

a) $P(35.8 \leq X \leq 36.2)$

mean = 36, standard deviation = 0.1 kg

$$Z = \frac{X - \mu}{\sigma} = \frac{35.8 - 36}{0.1} = -2$$

$$P(Z = -2) = 0.5 - 0.05395 = 0.44605$$

$$Z = \frac{X - \mu}{\sigma} = \frac{36.2 - 36}{0.1} = 2$$

$$P(Z = 2) = 0.97725 - 0.5 = 0.47725$$

in control

$$P(35.8 < X < 36.2) = 0.47725 \times 2 = 0.9545 = 1 - 0.9545 = 0.0455$$

b) $b(16; 16, 0.0455)$

$$= \binom{16}{16} \times 0.0455^{16} \times 0.9545^0 = 0.0455^{16} \times 0.9545^0$$

$$= 3.3743 \times 10^{-22} \times 0.47725$$

$$\Rightarrow \binom{16}{16} (0.0455)^{16} (0.9545)^0 + \binom{15}{1} (0.0455)^{15} (0.9545)^1$$

c) 16

$$C \times 0.0455^1 \times 0.9545^{16-1}$$

$$= 16 \times 0.0455 \times 0.4973$$

$$= 0.362$$

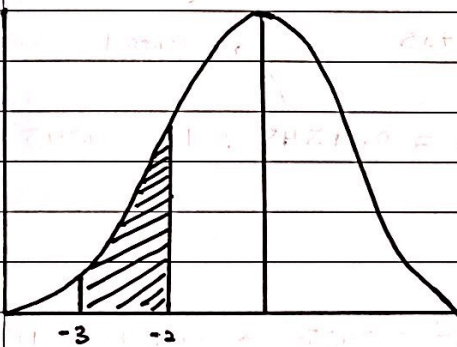
$$d) P\left(\frac{35.8}{36.6} \leq x \leq \frac{36.2}{37.4}\right)$$

$$z = \frac{35.8}{0.4} - 37 = -3$$

$$P(z = -3) = 0.5 - 0.00435 = 0.49565$$

$$z = \frac{36.2}{0.4} - 37 = -2$$

$$P(z = -2) = 0.5 - 0.05395 = 0.44605$$



$$0.49565 - 0.44605 = 0.0496$$

in control

$$1 - 0.0496 = 0.9504$$

$$\therefore 0.9504$$

Question 4

From question, $X = \text{duration}$

$$\sigma = 8$$

$$\mu = 28$$

a) $P(20 < X < 40)$

$$P\left(\frac{20-28}{8} < Z < \frac{40-28}{8}\right)$$

$$P(-1 < Z < 1.5)$$

By referring to distribution table, $P(-1 < Z < 1.5) = 0.7745$
 $= \underline{\underline{77.45\%}}$

b) $P(X < 30)$

$$P\left(Z < \frac{30-28}{8}\right)$$

$$P(Z < 0.25)$$

By referring to distribution table, $P(Z < 0.25) = 0.5987$
 $= \underline{\underline{59.87\%}}$

c) $P\left(\frac{Z}{X} > x\right) = 0.75$

$$Z = 0.68$$

$$\text{or } Z = \frac{X - \mu}{\sigma}$$

$$0.68 = \frac{X - 28}{8}$$

$$X = 33.44$$

$$\approx \underline{\underline{33 \text{ days}}}$$