



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

**SECI2143 PROBABILITY & STATISTICAL
DATA ANALYSIS**

SEMESTER II 2020/2021

ASSIGNMENT II

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Question 1

$P(A)$ v. easy

$P(B)$ easy

$P(A \cup B)$ easy

$P(A \cap B)$ diff

$P(B')$ v. easy

a) $0.34 + 0.29 + 0.08 = 0.71$

b) $0.34 + 0.17 + 0.12 = 0.63$

c) $1 - (0.12 + 0.08) = 0.8$

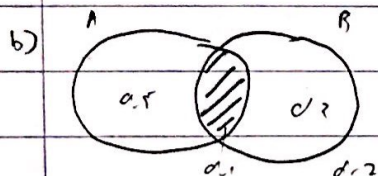
d) $0.17 + 0.08 = 0.25$

Question 2

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

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

$P(A \cap B) = 0.1$



c) 0.2

d) 0.2

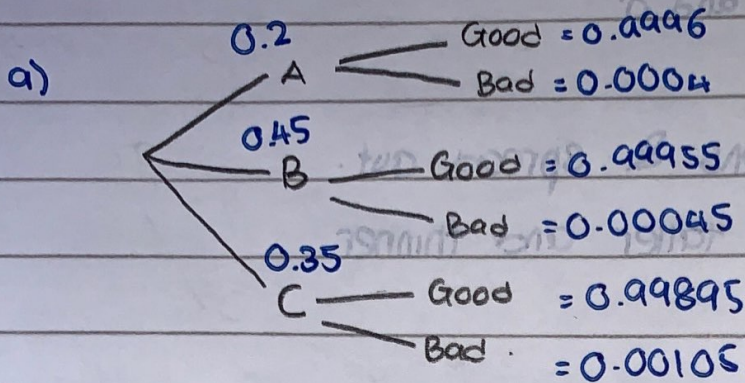
e) $P(A' \cup B') = P(A') + P(B') - P(A' \cap B')$

$= 0.4 + 0.7 - 0.2$

$= 0.9$

f) 0.5

Question 3 [10 marks]



$$P(\text{Bad} | A) = 0.002, \quad P(A \cap \text{Bad}) = 0.002(0.2) = 0.0004$$

$$P(\text{Bad} | B) = 0.001, \quad P(B \cap \text{Bad}) = 0.001(0.45) = 0.00045$$

$$P(\text{Bad} | C) = 0.003, \quad P(C \cap \text{Bad}) = 0.003(0.35) = 0.00105$$

b) Good service with airline

$$0.0004 + 0.00045 + 0.00105$$

$$P(\text{Bad}) = 0.0019$$

$$P(\text{Good}) = 1 - P(\text{Bad})$$

$$= 0.9981$$

$$c) P(B | \text{Good}) = \frac{P(\text{Good} | B) P(B)}{P(\text{Good})}$$

$$= \frac{0.99955(0.45)}{0.9981}$$

$$= 0.4507$$

Question 4 [20 marks]

Banana flavour : 70% / 0.7

Kurma flavour : 30% / 0.3

$$b(x; n, p) = \binom{n}{x} p^x q^{n-x}$$

20 customers.

a) Binomial random variable.

b) $n=8$ banana flavour.

$$\begin{aligned} P(X=8) &= \binom{20}{8} (0.7)^8 (0.3)^{20-8} \\ &= 125\,970 (0.7)^8 (0.3)^{12} \\ &= 0.0039 \end{aligned}$$

$$\begin{aligned} c) \quad P(7 \leq X \leq 10) &= P(X=7) + P(X=8) + P(X=9) + P(X=10) \\ &= \binom{20}{7} (0.7)^7 (0.3)^{13} + \binom{20}{8} (0.7)^8 (0.3)^{12} \\ &\quad + \binom{20}{9} (0.7)^9 (0.3)^{11} + \binom{20}{10} (0.7)^{10} (0.3)^{10} \\ &= 0.00102 + 0.0039 + 0.0120 + 0.03082 \\ &= 0.4774. \end{aligned}$$

$$\begin{aligned} d) \quad P(3 \leq X \leq 5) &= b(3; 20, 0.3) + b(4; 20, 0.3) + b(5; 20, 0.3) \\ &= \binom{20}{3} (0.3)^3 (0.7)^{17} + \binom{20}{4} (0.3)^4 (0.7)^{16} \\ &\quad + \binom{20}{5} (0.3)^5 (0.7)^{15} \\ &= 0.0716 + 0.1304 + 0.1789 \\ &= 0.3809. \end{aligned}$$

Question 5.

a) i. On third try

~~iii~~

$$(0.3)^{3-1} (0.7)$$

$$= 0.063$$

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

$$\begin{pmatrix} 1-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^0 + \begin{pmatrix} 2-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^1 + \begin{pmatrix} 3-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^2$$

$$0.7 + 0.21 + 0.063$$

$$= 0.973$$

~~$$b^*(7, 5, 0.7)$$~~

~~$$\begin{pmatrix} 7-1 \\ 5-1 \end{pmatrix} (0.7)^5 (0.3)^2$$~~

~~$$(15)(0.16807)(0.09)$$~~

~~$$= 0.2269$$~~

iii. within 5 to 7

$$b^*(5, 1, 0.7) + b^*(6, 1, 0.7) + b^*(7, 1, 0.7)$$

$$\begin{pmatrix} 5-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^4 + \begin{pmatrix} 6-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^5 + \begin{pmatrix} 7-1 \\ 1-1 \end{pmatrix} (0.7)^1 (0.3)^6$$

$$5.67 \times 10^{-3} + 1.701 \times 10^{-3} + 5.103 \times 10^{-4}$$

$$= 7.8813 \times 10^{-3}$$

b) $\mu = np$, $\sigma = \sqrt{npq}$, $\sigma^2 = npq$

$$\mu = (5)(0.7)$$

$$= 3.5$$

$$\sigma^2 = (5)(0.7)(0.3)$$

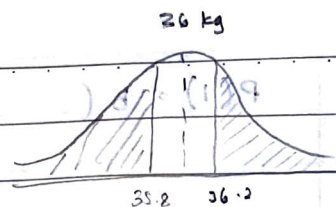
$$= 1.05$$

Question 6.

$$(a) \quad Z = \frac{35.8 - 36}{0.1}, \quad Z = \frac{36.2 - 36}{0.1}$$

$$Z = -2.0$$

$$Z = 2.0$$



$$P(Z = -2) = 0.02275$$

$$Z = \frac{35.8 - 36}{0.1}, \quad Z = \frac{36.2 - 36}{0.1}$$

$$P(Z = 2) = 0.97725$$

$$= -2$$

$$= 2$$

$$1 - 0.97725$$

$$= 0.02275$$

$$= 0.02275$$

$$= 0.97725$$

$$= 1 - 0.97725$$

$$0.02275 + 0.02275$$

$$= 0.0455$$

$$= 0.0455$$

$$= 0.02275$$

$$(b) \quad b(16, 0, 0.0455)$$

$$\binom{16}{0} (0.0455)^0 (0.9545)^{16}$$

$$(1)(1)(0.4747)$$

$$P(0) = 0.4747$$

$$(c) \quad b(16, 1, 0.0455)$$

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

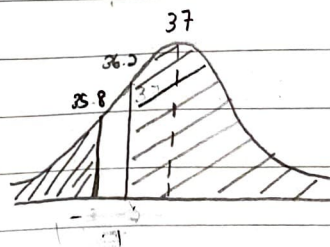
$$(16)(0.0455)(0.49732)$$

$$P(1) = 0.3621$$

$$(d) \quad \mu = 37 \text{ kg}, \quad \sigma = 0.4 \text{ kg}$$

$$Z = \frac{35.8 - 37}{0.4}$$

$$Z = \frac{36.2 - 37}{0.4}$$



$$Z = -3$$

$$Z = -2$$

$$P(Z = -3) = 0.00135$$

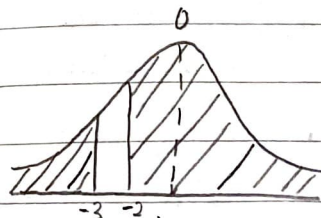
$$P(Z = -2) = 0.02275$$

$$1 - 0.02275$$

$$= 0.00135 + 0.97725$$

$$= 0.97725$$

$$= 0.9786$$



Question (7)

$$\mu = 28 \text{ days} \quad \sigma = 8 \text{ days}$$

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

$$Z = \frac{X - \mu}{\sigma} = \frac{20 - 28}{8}$$

 σ σ

$$= -1.00$$

$$Z = \frac{X - \mu}{\sigma} = \frac{40 - 28}{8}$$

 σ σ

$$= 1.50$$

$$P(Z = -1.00) = 0.5 - 0.15866 \\ = 0.34134$$

$$P(Z = 1.50) = 0.93319 - 0.5 \\ = 0.43319$$

$$P(20 < X < 40) = 0.34134 + 0.43319 \\ = 0.77453$$

b) $P(X < 30)$

$$Z = \frac{X - \mu}{\sigma} = \frac{30 - 28}{8}$$

 σ σ

$$= 0.25$$

$$P(Z < 0.25) = 0.59871$$

c) $75\% = 75^{\text{th}}$ percentile

Z value holding 75% of the value is between
0.67 and 0.68

We choose 0.67 because it holds more precise value

$$X = M + Z\sigma$$

$$= 28 + Z(8)$$

$$X = 28 + (0.67)(8)$$

$$= 33.36 \text{ days}$$

$$X = 33.36 \text{ days}, X \approx 34 \text{ days}$$