



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECI2143

PROBABILITY & STATISTICAL DATA ANALYSIS

Assignment 2

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Question 1

Very easy, $P(A) = 0.08$

easy, $P(B) = 0.29$

average, $P(C) = 0.34$

difficult, $P(D) = 0.17$

Very difficult, $P(E) = 0.12$

(a) Average, easy, or Very easy

$$P(C \cup B \cup A)$$

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

$$= 0.08 + 0.29 + 0.34$$

$$= 0.71$$

(b) Average, difficult or very difficult

$$P(C \cup D \cup E)$$

$$= P(C) + P(D) + P(E)$$

$$= 0.34 + 0.17 + 0.12$$

$$= 0.63$$

(c) Neither very difficult nor very easy

$$1 - P(E \cup A) = 1 - [P(E) + P(A)]$$

$$= 1 - [0.12 + 0.08]$$

$$= 1 - 0.2$$

$$= 0.8$$

(d) Difficult or very easy

$$P(D \cup A) = P(D) + P(A)$$

$$= 0.17 + 0.08$$

$$= 0.25$$

Question 2

$$P(A) = 0.60, P(B) = 0.30, P(A \cup B) = 0.8$$

(a) $P(A \cap B)$

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

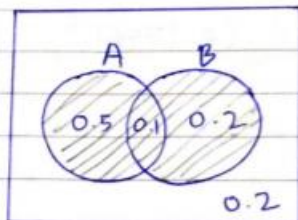
$$0.80 = 0.60 + 0.30 - P(A \cap B)$$

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

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

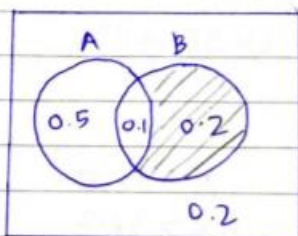
Question 2

b)



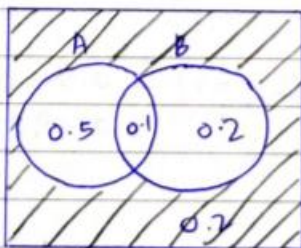
$$P(A \cup B) = 0.8$$

c)



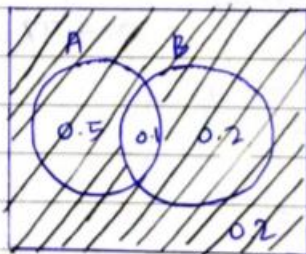
$$P(A' \cap B) = 0.2$$

d)



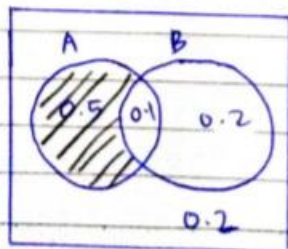
$$P(A' \cap B') = 0.2$$

e)



$$P(A' \cup B') = 1 - 0.1 = 0.9$$

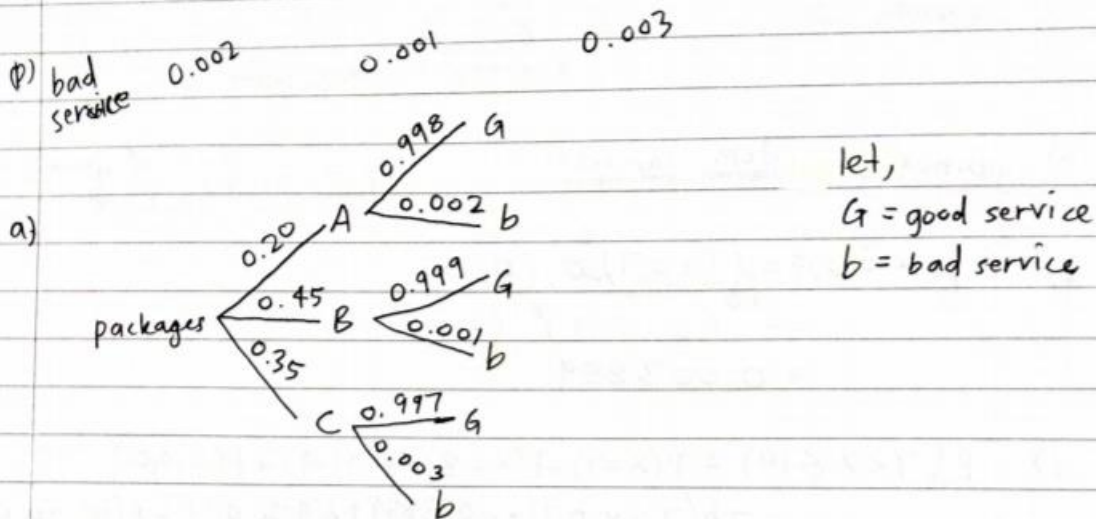
f)



$$P(A \cap B') = 0.5$$

Question 3

$$A = 0.20, B = 0.45, C = 0.35$$



(b) Good customer service in the airlines

$$\begin{aligned}
 &P(A \cap G) + P(B \cap G) + P(C \cap G) \\
 &= [0.2(0.998)] + [0.45(0.999)] + [0.35(0.997)] \\
 &= 0.1996 + 0.44955 + 0.34895 \\
 &= 0.9981 \approx 0.9
 \end{aligned}$$

(c) Given that the package is operating smoothly, what is the probability that it is in package B.

$$\begin{aligned}
 P(B \cap G) &= [0.45 \times 0.999] \\
 &= 0.44955 \approx 0.45
 \end{aligned}$$

Question 4

Banana Flavour, $P(B) = 0.70$

Kurma flavour, $P(K) = 0.30$

X = no. of dairy products

(a) X is a binomial random variable @ geometry random variable?

X is a binomial random variable

(b) Banana flavour

$x=8$, $n=20$, $p=0.70$, $q=0.3$

$$\begin{aligned} P(X=8) &= \binom{20}{8} (0.70)^8 (0.3)^{12} \\ &= 2.8993 \times 10^{-3} \\ &= 0.0039 \end{aligned}$$

(c) Banana

$n=20$, $p=0.7$, $q=0.3$

$$\begin{aligned} P(7 \leq X \leq 10) &= P(X=7) + P(X=8) + P(X=9) + P(X=10) \\ &= \binom{20}{7} (0.7)^7 (0.3)^{13} + \binom{20}{8} (0.7)^8 (0.3)^{12} + \binom{20}{9} (0.7)^9 (0.3)^{11} + \binom{20}{10} (0.7)^{10} (0.3)^{10} \\ &= 0.04970 \approx 0.048 \end{aligned}$$

(d) Kurma

$n=20$, $p=0.3$, $q=0.7$

$$\begin{aligned} P(3 \leq X \leq 5) &= P(X=3) + P(X=4) + P(X=5) \\ &= \binom{20}{3} (0.3)^3 (0.7)^{17} + \binom{20}{4} (0.3)^4 (0.7)^{16} + \binom{20}{5} (0.3)^5 (0.7)^{15} \\ &= 0.38089 \approx 0.38 \end{aligned}$$

Question 5

$$\text{Pass} = 0.7$$

$$\text{Fail} = 0.3$$

$$(a)(i) X=3 ; P(3) = (1-0.7)^2 (0.7) \\ = 0.063$$

(ii) Before 4th try



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

$$= (1-0.7)^0 (0.7) + (1-0.7)^1 (0.7) + (1-0.7)^2 (0.7) \\ = 0.973$$

(iii) At the 5th after 11th try



$$P(X=12) = (1-0.7)^{11} (0.7) \\ = 1.24 \times 10^{-6} \approx 0.00000124$$

(b) mean, variance $\rightarrow$ pass 5 trials

$$\mu_x = \frac{1}{p}$$

$$\mu_x = \frac{1}{0.7} = \frac{10}{7} \approx 1.43$$

$$\text{variance} = \sigma_x^2 = \frac{(1-p)}{p^2}$$

$$\sigma_x^2 = \frac{(1-0.7)}{(0.7)^2}$$

$$= 0.6122$$

(Full kena tolak!)

Question 6

normally distributed, mean = 36 S.D. = 0.1

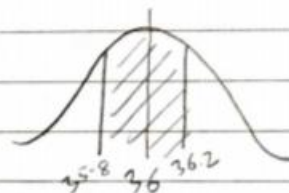
$$\leftarrow \text{X} < 35.8 \text{ or } X > 36.2$$

$$(a) \mu = 36, \sigma = 0.1$$

$$P(X < 35.8) \quad P(X > 36.2)$$

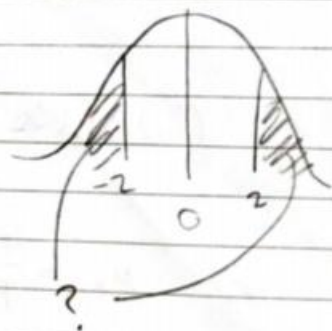
$$Z = \frac{X - \mu}{\sigma} = \frac{35.8 - 36}{0.1} = -2$$

$$P(Z = -2) = 0.5 - 0.0228 = 0.4772$$



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

$$P(Z = 2) = 0.9772 - 0.5 = 0.4772$$



$$P(-2 \leq Z \leq 2) = 0.4772 + 0.4772 = 0.9544$$

$$P(\text{out of control}) = 1 - 0.9544 = 0.0456$$

in control

Question 6

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

$$x=0 \quad q=0.9544$$

$$b(x; n, p) = b(0; 16, 0.0456)$$

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

$$= 0.4739$$

$$(c) \quad x=1$$

$$b(x; n, p) = b(1; 16, 0.0456)$$

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

$$= 0.3623$$

$$(d) \quad \mu=37 \quad \sigma=0.4$$

$$X < 35.8$$

$$X > 36.2$$



$$Z = \frac{X - \mu}{\sigma} = \frac{35.8 - 37}{0.4}$$

$$= -3$$

$$P(Z \leq -3) = 0.5 - 0.0044$$

$$= 0.4956$$



$$Z = \frac{X - \mu}{\sigma} = \frac{36.2 - 37}{0.4}$$

$$= -2$$

$$P(Z \geq -2) = 0.5 + 0.0540$$

$$= 0.5540$$

$$P(-3 \leq Z \leq -2) = 0.4956 - 0.5540$$

$$= 0.0414$$

$$P(\text{out of control}) = 1 - 0.0414$$

$$= 0.9586$$

Question 7

normal distribution



mean = 28 S.D = 8

(a)

$P(20 < X < 40)$

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

$$Z = \frac{20 - 28}{8}$$

$$= -1$$

$$P(Z = -1) = 0.5 - 0.1587 \\ = 0.3413$$

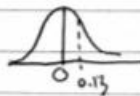
$$Z = \frac{40 - 28}{8}$$

$$= 1.5$$

$$P(Z = 1.5) = 0.9332 - 0.5 \\ = 0.4332$$

$$P(20 < X < 40) = 0.3413 + 0.4332 \\ = 0.7745$$

(b) $P(X < 30)$



$$P(X \leq 29)$$

$$Z = \frac{29 - 28}{8}$$

$$= 0.125 \therefore 0.13$$

$$P(Z = 0.13) = 1 - 0.5517 \\ = 0.4483$$

c)

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

$$1 - 0.75 = 0.25$$

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

$$X = ?$$

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

$$X = 22.64$$

$$\therefore X = 23$$