



## PROBABILITY & STATISTICAL DATA ANALYSIS

SECI2143-02

### ASSIGNMENT 2

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### Question 1

$$\text{very easy} : P(A) = 0.08$$

$$\text{easy} : P(B) = 0.29$$

$$\text{average} : P(C) = 0.34$$

$$\text{difficult} : P(D) = 0.17$$

$$\text{very difficult} : P(E) = 0.12$$

a) Average, easy or very easy

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

b) Average, difficult or very difficult

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

c) Neither very difficult nor very easy

$$\begin{aligned} 1 - P(E) - P(A) &= 1 - 0.12 - 0.08 \\ &= 0.80 \end{aligned}$$

d) Difficult or very easy

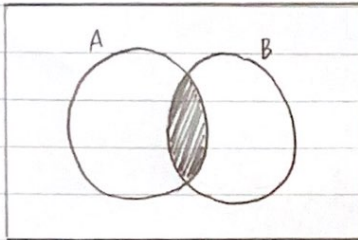
$$\begin{aligned} P(D \text{ or } A) &= P(D) + P(A) \\ &= 0.17 + 0.08 \\ &= 0.25 \end{aligned}$$



Question 2

$$\begin{aligned} \text{a) } P(A \cap B) &= P(A) \cdot P(B) \\ &= 0.60 \cdot 0.30 = 0.18. \end{aligned}$$

b)



$$\begin{aligned} \text{c) } P(A' \cap B) &= P(A') \cdot P(B) \\ &= (1 - 0.60)(0.30) = 0.12. \end{aligned}$$

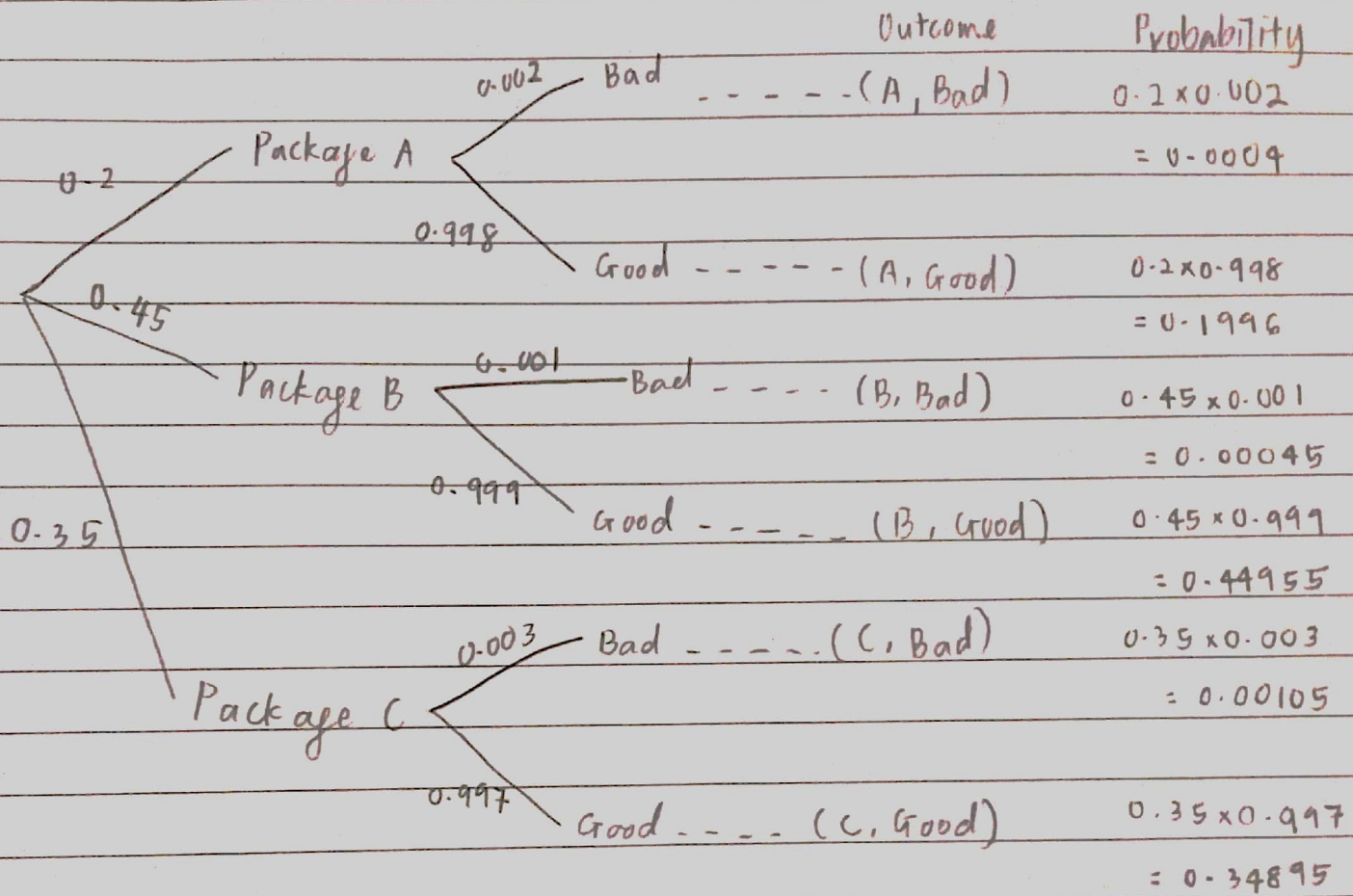
$$\begin{aligned} \text{d) } P(A' \cap B') &= P(A') \cdot P(B') \\ &= (1 - 0.60)(1 - 0.30) = 0.28. \end{aligned}$$

$$\begin{aligned} \text{e) } P(A' \cup B') &= P(A') + P(B') - P(A' \cap B') \\ &= 0.4 + 0.7 - 0.28 \\ &= 0.82 \end{aligned}$$

$$\begin{aligned} \text{f) } P(A \cap B') &= P(A) \cdot P(B') \\ &= 0.60 \cdot 0.7 = 0.42. \end{aligned}$$

## Question 3.

a)



b) Good service =  $\{(A, \text{Good}), (B, \text{Good}), (C, \text{Good})\}$

$$(A, \text{Good}) = 0.1996$$

$$(B, \text{Good}) = 0.44955$$

$$(C, \text{Good}) = 0.34895$$

$$0.1996 + 0.44955 + 0.34895 = 0.9981$$

c)  $0.9981 \times 0.44955 = 0.44870$



Question 4.

70% - banana, 30% - kurma,  $x$  = no. of dairy product purchased  
among 20 customers.  
 $n = 20$ .

a)  $x$  is binomial random variable

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

$$b(8; 20, 0.7) = \binom{20}{8} (0.7)^8 (0.3)^{20-8}$$

$$= 3.8593 \times 10^{-3}$$

$$= 0.0039$$

c)  $p(7 < X \leq 10) = p(X=8) + p(X=9) + p(X=10)$  - banana

$$b(8; 20, 0.7) + b(9; 20, 0.7) + b(10; 20, 0.7)$$

$$= \left[ \binom{20}{8} (0.7)^8 (0.3)^{20-8} \right] + \left[ \binom{20}{9} (0.7)^9 (0.3)^{20-9} \right] + \left[ \binom{20}{10} (0.7)^{10} (0.3)^{20-10} \right]$$

$$= 0.0039 + 0.0120 + 0.0308$$

$$= 0.0467$$

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

$$= b(3; 20, 0.30) + b(4; 20, 0.30) + b(5; 20, 0.30)$$

$$= \left[ \binom{20}{3} (0.30)^3 (0.70)^{20-3} \right] + \left[ \binom{20}{4} (0.30)^4 (0.70)^{20-4} \right]$$

$$+ \left[ \binom{20}{5} (0.30)^5 (0.70)^{20-5} \right]$$

$$= 0.0716 + 0.1304 + 0.1789$$

$$= 0.3809$$

## Question 5

past test,  $p = 0.7$  ; success,  $k = 1$   
 don't past test,  $q = 1 - 0.7 = 0.3$

a) i On the third try

assume first success on 3rd try =

$$g(3; 0.7) = 0.3^2 (0.7) = 0.063$$

ii Before the fourth try

$$\begin{aligned} P(X < 4) &= P(X=3) + P(X=2) + P(X=1) \\ &= \left[ \binom{2}{0} (0.7)^1 (0.3)^1 \right] + \left[ \binom{1}{0} (0.7)^1 (0.3)^1 \right] + \left[ \binom{0}{0} (0.7)^1 (0.3)^0 \right] \\ &= 0.063 + 0.21 + 0.7 \\ &= 0.973 \end{aligned}$$

iii Pass within 5th to 7th try

$$\begin{aligned} P(5 \leq X \leq 7) &= P(X=5) + P(X=6) + P(X=7) \\ &= \left[ \binom{4}{0} (0.7)^1 (0.3)^4 \right] + \left[ \binom{5}{0} (0.7)^1 (0.3)^5 \right] + \left[ \binom{6}{0} (0.7)^1 (0.3)^6 \right] \\ &= 0.00567 + 0.001701 + 0.00051 \\ &= 0.0079 \end{aligned}$$

b)  $\mu = np = 5(0.7) = 3.5$

$$\sigma^2 = npq = 5(0.7)(0.3) = 1.05$$



### Question 6

$$\begin{aligned} \text{a) } x = 35.8 & \Rightarrow z = \frac{35.8 - 36}{0.1} \\ & = -2 \end{aligned}$$

$$\begin{aligned} x = 36.2 & \Rightarrow z = \frac{36.2 - 36}{0.1} \\ & = 2 \end{aligned}$$

z score

$$P(z < -2) = 0.02275$$

$$P(z > 2) = 0.02275$$

$$\begin{aligned} \text{probability declared out of control} &= P(x < 35.8) + P(x > 36.2) \\ &= P(z < -2) + P(z > 2) \\ &= 0.02275 + 0.02275 \\ &= \underline{\underline{0.0455}} \end{aligned}$$

b) inspection,  $n = 16$

$$\begin{aligned} P(x=0) &= \frac{16!}{0!(16-0)!} (0.0455)^0 (1 - 0.0455)^{16-0} \\ &= 1 \times 1 \times (0.9545)^{16} \\ &= \underline{\underline{0.4747}} \end{aligned}$$

Q6

$$\begin{aligned} c) \quad P(X=1) &= \frac{16!}{1!(16-1)!} \times (0.0455)^1 \times (1-0.0455)^{16-1} \\ &= 16 \times 0.0455 \times 0.4973 \\ &= \underline{\underline{0.36203}} \end{aligned}$$

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

$$X = 35.8 \Rightarrow Z = \frac{35.8 - 37}{0.4} = -3$$

$$X = 36.2 \Rightarrow Z = \frac{36.2 - 37}{0.4} = -2$$

probability declared  
out of control

$$\begin{aligned} &= P(X > 36.2) + P(X < 35.8) \\ &= 0.97725 + 0.00135 \\ &= \underline{\underline{0.9786}} \end{aligned}$$



## Question 7

a)  $\mu = 28$

$$\sigma = 8$$

$$X_1 = 20$$

$$X_2 = 40$$

$$Z_1 = \frac{X_1 - \mu}{\sigma}$$

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

$$= -1.000$$

$$= 0.15866$$

$$Z_2 = \frac{40 - 28}{8}$$

$$= 1.5$$

$$= 0.93319$$

$$P(28 \leq X \leq 40)$$

$$P(Z = -1.000)$$

$$= 0.5 - 0.15866$$

$$= 0.34134$$

$$P(Z = 1.5)$$

$$= 0.93319 - 0.5$$

$$= 0.43319$$

$$0.34134 + 0.43319 = 0.77453$$

b)  $X < 30$

$$Z = \frac{30 - 28}{8}$$

$$= 0.25$$

$$= 0.59871$$

No.: .....

c)

$$X = \mu + z \cdot \sigma$$

$$z = 0.67$$

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

$$= 33.36$$

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