



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECI2143 – PROBABILITY AND STATISTICAL DATA ANALYSIS

ASSIGNMENT 2

SECTION 02

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QUESTION 1

Question 1

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

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

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

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

QUESTION 2

DATE

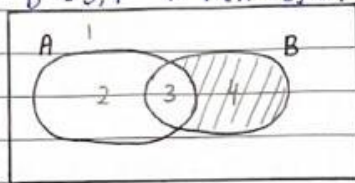
QUESTION 2

If A and B are two events and $P(A) = 0.60$, $P(B) = 0.30$ and $P(A \cup B) = 0.80$, find:

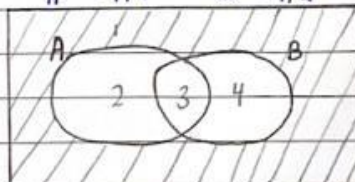
(a) $P(A \cap B) = P(A) + P(B) - P(A \cup B)$
 $= 0.60 + 0.30 - 0.80$
 $= 0.10$

(b) Based on the information given and the answer in (i), complete the following Venn Diagram by labelling the corresponding probability.

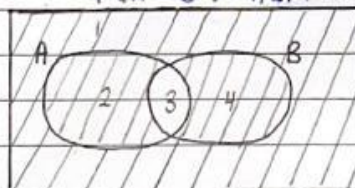
(c) $P(A' \cap B)$; $A = 2, 3$; $A' = 1, 4$
 $B = 3, 4$; $P(A' \cap B) = 4$



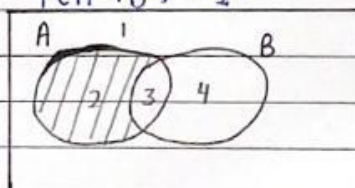
(d) $P(A' \cap B')$; $A = 2, 3$, $B = 3, 4$
 $A' = 1, 4$, $B' = 1, 2$; $P(A' \cap B') = 1$



(e) $P(A' \cup B')$; $A' = 1, 4$; $B' = 1, 2$
 $P(A' \cup B') = 1, 2, 4$

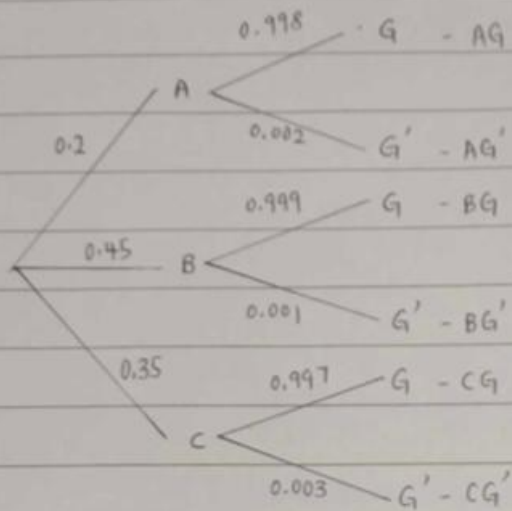


(f) $P(A \cap B')$; $A = 2, 3$, $B = 3, 4$; $B' = 1, 2$
 $P(A \cap B') = 2$



QUESTION 3

a)



$$\begin{aligned} \text{b) } P(AG) &= 0.2 \times 0.998 \\ &= 0.1996 \end{aligned}$$

$$\begin{aligned} P(AG \cup BG \cup CG) &= 0.1996 + 0.4496 + 0.3490 \\ &= 0.9982 \end{aligned}$$

$$\begin{aligned} P(BG) &= 0.45 \times 0.999 \\ &= 0.4496 \end{aligned}$$

$$\begin{aligned} P(CG) &= 0.35 \times 0.997 \\ &= 0.3490 \end{aligned}$$

$$\begin{aligned} \text{c) } P(B|G) &= \frac{P(B \cap G)}{P(G)} \\ &= \frac{0.45(0.999)}{0.9982} \\ &= 0.4504 \end{aligned}$$

QUESTION 4

4. Farm Milk Sdn. Bhd produce dairy products. 70% of the dairy product sold is barong flavour milk and 30% kurma. Type of dairy products purchased by 20 customers will be recorded. Given a random variable x as number of dairy products purchased among these 20 cust answer the follows cust:

a) x is binomial random variable

b) barong = 0.7, kurma = 0.3

calculate probability that exactly eight dairy product purchased are barong flavour.

$$= {}^{20}_8 (0.7)^8 (0.3)^{12}$$
$$= 3.859 \times 10^{-3}$$

c) calculate the probability that between seven and ten (inclusively) barong flavour.

$$P(7) + P(8) + P(9) + P(10)$$

$$P(7) = {}^{20}_7 (0.7)^7 (0.3)^{13}$$
$$= 1.018 \times 10^{-3}$$

$$P(9) = {}^{20}_9 (0.7)^9 (0.3)^{11}$$
$$= 0.012$$

$$P(8) = {}^{20}_8 (0.7)^8 (0.3)^{12}$$
$$= 3.856 \times 10^{-3}$$

$$P(10) = {}^{20}_{10} (0.7)^{10} (0.3)^{10}$$
$$= 0.031$$

$$1.018 \times 10^{-3} + 3.856 \times 10^{-3} + 0.012 + 0.031$$
$$= 0.04784$$

d) $P(3) + P(4) + P(5)$

$$P(3) = {}^{20}_3 (0.3)^3 (0.7)^{17}$$
$$= 0.0716$$

$$P(4) = {}^{20}_4 (0.3)^4 (0.7)^{16}$$
$$= 0.1304$$

$$P(5) = {}^{20}_5 (0.3)^5 (0.7)^{15}$$
$$= 0.1789$$

$$\therefore 0.0716 + 0.1304 + 0.1789$$
$$= 0.3809$$

QUESTION 5

Question 5

$$\begin{aligned} \text{a)} \quad P(X=3) &= b(3; 1, 0.7) \\ &= \binom{3-1}{1-1} (0.7)^1 (0.3)^{3-1} \\ &= 0.063 \end{aligned} \quad \begin{aligned} q &= 1 - 0.7 \\ &= 0.3 \end{aligned}$$

$$\begin{aligned} \text{ii)} \quad P(X < 4) &= P(1 \leq X \leq 3) \\ &= P(X=1) + P(X=2) + P(X=3) \\ &= b(1; 1, 0.7) + b(2; 1, 0.7) + 0.063 \\ &= \binom{1-1}{1-1} (0.7)^1 (0.3)^{1-1} + \binom{2-1}{1-1} (0.7)^1 (0.3)^{2-1} + 0.063 \\ &= 0.7 + 0.21 + 0.063 \\ &= 0.973 \end{aligned}$$

$$\begin{aligned} \text{iii)} \quad P(5 \leq X \leq 7) &= P(X=5) + P(X=6) + P(X=7) \\ &= b(5; 1, 0.7) + b(6; 1, 0.7) + b(7; 1, 0.7) \\ &= \binom{5-1}{1-1} (0.7)^1 (0.3)^{5-1} + \binom{6-1}{1-1} (0.7)^1 (0.3)^{6-1} + \binom{7-1}{1-1} (0.7)^1 (0.3)^{7-1} \\ &= 5.67 \times 10^{-3} + 1.701 \times 10^{-3} + 5.103 \times 10^{-4} \\ &= 7.8813 \times 10^{-3} \end{aligned}$$

$$\begin{aligned} \text{b)} \quad \mu &= 5(0.7) & \sigma^2 &= 5(0.7)(0.3) \\ &= 3.5 & &= 1.05 \end{aligned}$$

QUESTION 6

DATE

QUESTION 6

At QT Sugar Factory the amounts which go into bag of sugar are supposed to be normally distributed with mean 36kg and standard deviation 0.1kg. Once every 30 minutes a bag is selected from the production line, and its contents are noted precisely. If the amount of the bag goes below 35.8 kg or above 36.2kg, then the bag will be declared out of control.

- (a) If the process is in control, meaning $\mu = 36$ kg and $\sigma = 0.1$ kg, find the probability that the bag will be declared out of control.

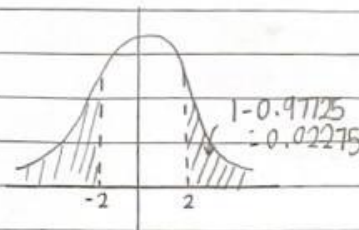
$$Z = \frac{X - \mu}{\sigma} = \frac{36.2 - 36}{0.1} \\ = 2 \\ = 0.97725$$

$$Z = \frac{X - \mu}{\sigma} = \frac{35.8 - 36}{0.1} \\ = -2 \\ = 0.02275$$

$\therefore P(\text{out of control})$

$$= 0.02275 + 0.02275$$

$$= 0.0455$$



- (b) In the situation of (a), find the probability that the number of bag found out of control in an eight-hour day (16 inspections) will be zero.

$$p(0) = 0.0455$$

$$P(X=0) = {}^{16}C_0 \times (0.0455)^0 \times (1-0.0455)^{16} \\ = 0.4747$$

- (c) In the situation of (a), find the probability that the number of bag found out control in an eight-hour day (16 inspections) will be exactly one.

$$P(X=1) = {}^{16}C_1 \times (0.0455)^1 \times (1-0.0455)^{15} \\ = 0.3621$$

- (d) If the process shifts so that $\mu = 37\text{kg}$ and $\sigma = 0.4\text{kg}$, find the probability that a bag will be declared out of control.

$$\mu = 37, \sigma = 0.4$$

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

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

$$= -2$$

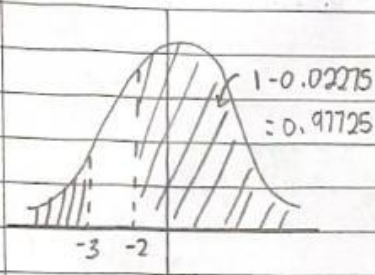
$$= 0.02275$$

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

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

$$= -3$$

$$= 0.00135$$



$$\therefore P(\text{out of control})$$

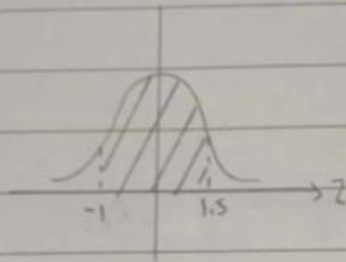
$$= 0.00135 + 0.97725$$

$$= 0.9786$$

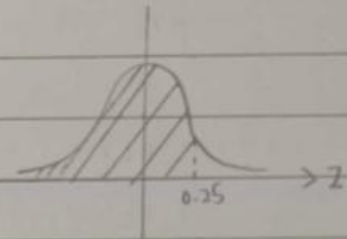
QUESTION 7

Question 7

a) $\mu = 28$ $P(20 \leq x \leq 40) = P\left(\frac{20-28}{8} \leq z \leq \frac{40-28}{8}\right)$
 $\sigma = 8$ $= P(-1 \leq z \leq 1.5)$
 $= (0.5 - 0.1587) + (0.9332 - 0.5)$
 $= 0.3413 + 0.4332$
 $= 0.7745$



b) $P(x < 30) = P\left(z < \frac{30-28}{8}\right)$
 $= P(z < 0.25)$
 $= 0.5987$



c) $P(x > a) = 0.75$ $P(z > -0.67) = 0.25$
 $1 - 0.75 = 0.25$ $\frac{a-28}{8} = -0.67$
 $a - 28 = -5.36$
 $a = 22.64$
 $\approx 23 \text{ days}$