



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECI2143-01
PROBABILITY & STATISTICAL DATA
ANALYSIS

ASSIGNMENT 1

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Question 1

$$P(A) = 0.08, P(B) = 0.29, P(C) = 0.34, P(D) = 0.17, P(E) = 0.12$$

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

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

$$\begin{aligned}(c) &= 1 - [P(E) + P(A)] \\ &= 1 - (0.12 + 0.08) \\ &= 1 - 0.2 \\ &= 0.80 \neq\end{aligned}$$

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

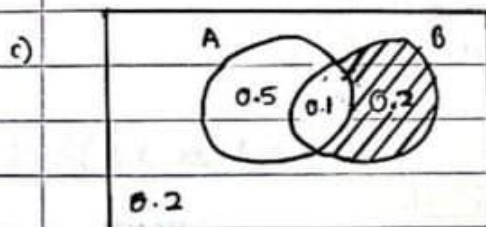
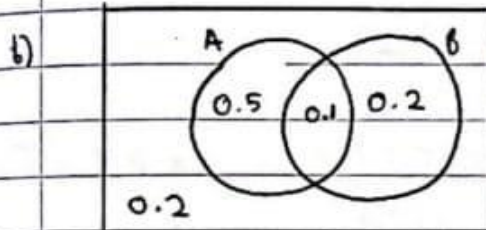
Question 2

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

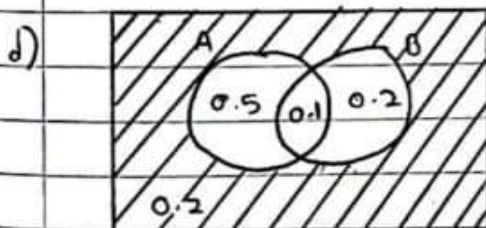
$$0.8 = 0.6 + 0.3 - P(A \cap B)$$

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

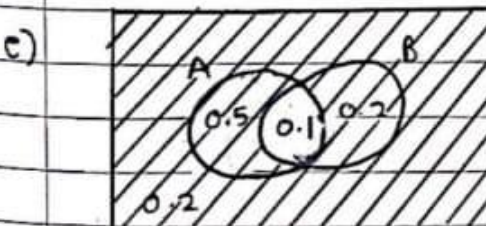
$$= 0.1$$



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

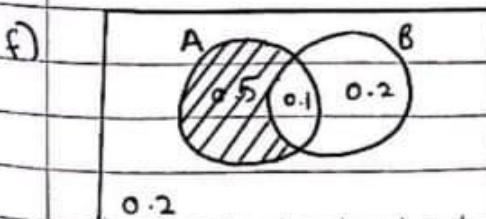


$$P(A' \cap B') = 0.2$$



$$P(A' \cup B') = 0.5 + 0.2 + 0.2$$

$$= 0.9$$

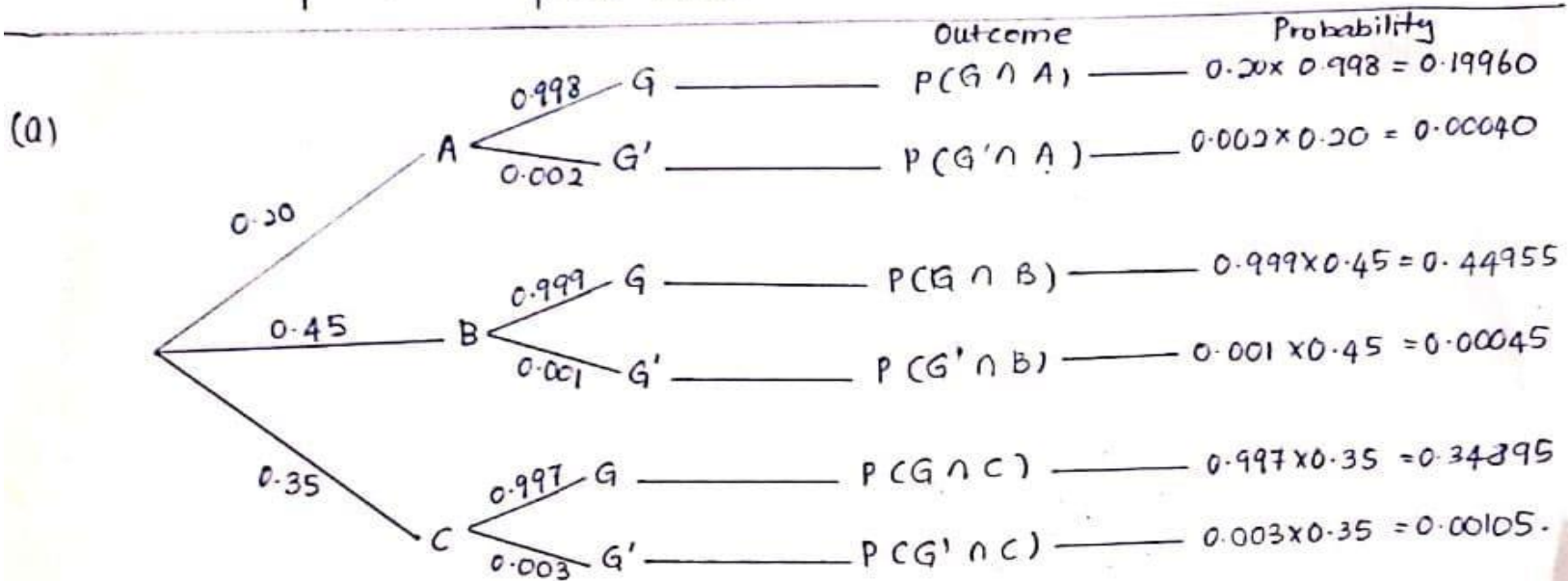


$$P(A \cap B') = 0.5$$

Question 3.

A: Package A, B: Package B, C: Package C, G: Good service, G': Bad Service.

Package A	Package B	Package C
$P(A) = 0.20$	$P(B) = 0.45$	$P(C) = 0.35$
$P(G) = 0.998$	$P(G) = 0.999$	$P(G) = 0.997$
$P(G') = 0.002$	$P(G') = 0.001$	$P(G') = 0.003$



(b) $P(G) = P(G \cap A) + P(G \cap B) + P(G \cap C)$

$$= 0.19960 + 0.44955 + 0.34895$$

$$= 0.99810$$

(c) $P(B|G) = \frac{P(G \cap B)}{P(G)}$

$$= \frac{0.44955}{0.99810}$$

$$= 0.45041$$

Question 4

a) Binomial random variable

$$\begin{aligned} b) \quad b(8; 20, 0.7) &= \binom{20}{8} (0.7)^8 (0.3)^{12} \\ &= (125970)(0.05764801)(5.31441 \times 10^{-3}) \\ &= 3.85928 \times 10^{-3} = 0.003859 \end{aligned}$$

$$\begin{aligned} c) \quad P(7 \leq x \leq 10) &= b(7; 20, 0.7) + b(8; 20, 0.7) + b(9; 20, 0.7) + \\ &\quad b(10; 20, 0.7) \\ &= 0.002495 + 0.003859 + 0.012007 + 0.030817 \\ &= 0.04923 \end{aligned}$$

$$\begin{aligned} d) \quad P(3 \leq x \leq 5) &= b(3; 20, 0.3) + b(4; 20, 0.3) + b(5; 20, 0.3) \\ &= 0.0716 + 0.1304 + 0.1789 \\ &= 0.3809 \end{aligned}$$

Question 5

$$(a) (i) P(X=x) = \binom{n-1}{k-1} (p)^k (q)^{n-k}$$

$$\begin{aligned} P(X=3) &= \binom{3-1}{1-1} (0.7)^1 (0.3)^2 \\ &= \binom{2}{0} (0.7) (0.09) \\ &= 0.063 \# \end{aligned}$$

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

$$\begin{aligned} &= \left[\binom{1-1}{1-1} (0.7)^1 (0.3)^0 \right] + \left[\binom{2-1}{1-1} (0.7)^1 (0.3)^1 \right] + \left[\binom{3-1}{1-1} (0.7)^1 (0.3)^2 \right] \\ &= [1 \times 0.7 \times 1] + [1 \times 0.7 \times 0.3] + [1 \times 0.7 \times 0.09] \\ &= 0.7 + 0.21 + 0.063 \\ &= 0.973 \# \end{aligned}$$

$$(iii) P(X=x) = \binom{x-1}{k-1} (1-p)^{x-k} p^k$$

$$\begin{aligned} P(X=7) &= \binom{7-1}{5-1} (1-0.7)^2 (0.7)^5 \\ &= \binom{6}{4} (0.3)^2 (0.7)^5 \\ &= 0.2269 \# \end{aligned}$$

$$(b) \mu = \frac{k}{p}$$

$$= \frac{5}{0.7}$$

$$= 7.1429$$

$$= 7 \#$$

$$\sigma^2 = \frac{k(1-p)}{p^2}$$

$$= \frac{5(1-0.7)}{(0.7)^2}$$

$$= \frac{1.5}{0.49}$$

$$= 3.0612$$

$$= 3 \#$$

$$\begin{aligned}
 \text{c) a) } P(35.8 \leq X \leq 36.2) &= P\left(\frac{35.8 - 36}{0.1} \leq Z \leq \frac{36.2 - 36}{0.1}\right) \\
 &= P(-2 \leq Z \leq 2) \\
 &= P(Z > 2) - P(Z > -2) \\
 &= 0.9772 - 0.0228 \\
 &= 0.9544
 \end{aligned}$$

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

$$\text{b) } \mu = 0, n = 16, p = 0.0456$$

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

$$\begin{aligned}
 b(0; 16, 0.0456) &= \binom{16}{0} (0.0456)^0 (0.9544)^{16} \\
 &= (1)(1)(0.4739) \\
 &= 0.4739
 \end{aligned}$$

$$\text{c) } x = 1, n = 16, p = 0.0456$$

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

$$\begin{aligned}
 b(1; 16, 0.0456) &= \binom{16}{1} (0.0456)^1 (0.9544)^{15} \\
 &= 0.3623
 \end{aligned}$$

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$$d) P(35.8 \leq X \leq 36.2) = P\left(\frac{35.8 - 37}{0.4} \leq Z \leq \frac{36.2 - 37}{0.4}\right)$$

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

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

$$= 0.0228 - 0.0013$$

$$= 0.0215$$

$$P(\text{Out of control}) = 1 - 0.0215$$

$$= 0.9785$$

$$7a) P(20 \leq X \leq 40)$$

$$Z = \frac{X - \mu}{\sigma} \quad ; \quad Z = \frac{X - \mu}{\sigma} = \frac{40 - 28}{8} = 1.5$$

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

$$= -1$$

$$P(Z = -1) = 0.1587$$

$$P(Z = 1.5) = 0.9332$$

$$P(-1 \leq Z \leq 1.5) = 0.9332 - 0.1587$$

$$= 0.7745 = 77.45\%$$

$$b) P(X \leq 30)$$

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

$$= \frac{30 - 28}{8} = 0.25$$

$$P(Z = 0.25) = 0.5987 = 59.87\%$$

$$c) P(X > \mu) = 0.75$$

$$1 - P(X \leq \mu) = 0.75$$

$$P(X \leq \mu) = 1 - 0.75 = 0.25$$

$$\frac{X - \mu}{\sigma} = -0.67$$

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

$$X = 22.64$$

$$X \approx 23 \text{ days}$$