UNIVERSITI TEKNOLOGI MALAYSIA

ASSIGNMENT 2

UNIVERSITI TEKNOLOGI MALAYSIA

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SECTION/COURSE CODE	**: [SECI 2143] [01] – [PROBABILITY & STATISTICAL DATA ANALYSIS]**
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Case Study Report submitted to School of Computing, Univerisiti Teknologi Malaysia in partial fulfilment to complete the SECI 2143 Assignment for Semester 2 session 2020/2021

Question 1

Let

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

very easy, easy, average, difficult, very difficult

a) Average, easy or very easy $= P(C) + P(B) + P(A)$

$= 0.34 + 0.29 + 0.08$

$= 0.71$

b) Average, difficult or very difficult $= P(C) + P(D) + P(E)$

$= 0.34 + 0.17 + 0.12$

$= 0.63$

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c) Neither very difficult nor easy

$= 1 - P(E \cup A)$

$= 1 - (0.12 + 0.08)$

$= 0.80$

10

d) Difficult or very easy

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

$= 0.17 + 0.08$

$= 0.25$

Question 2

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

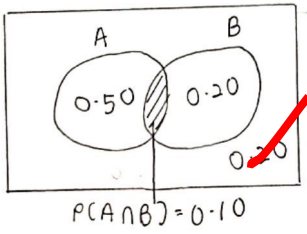
$P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= 0.60 + 0.30 - 0.80$

$= 0.10$

2

b)



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

$0.60 - 0.10 = 0.50$

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

$0.30 - 0.10 = 0.20$

$1 - P(A \cup B) = 1 - 0.80$

$= 0.20$

3

c) $P(A' \cap B) = P(B) - P(A \cap B)$

$= 0.30 - 0.10$

$= 0.20$

$P(A) \times P(B)$

$= 0.4 \times 0.3$

$= 0.12$

d) $P(A' \cap B') = P(A \cap B)'$ De Morgan's Law

$= 1 - P(A \cup B)$

$= 1 - 0.80$

$= 0.20$ ✓

$P(A') \times P(B') = 0.28$

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e) $P(A' \cup B') = P(A \cup B)'$ De Morgan's Law

$= 1 - P(A \cup B)$

$= 1 - 0.10$

$= 0.90$ ✓

$P(A') + P(B') - P(A' \cap B')$

$= 0.82$

f) $P(A \cap B') = P(A) - P(A \cap B)$

$= 0.60 - 0.10$

$= 0.50$ ✓

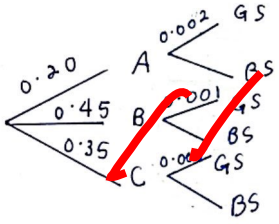
$P(A) \times P(B')$

$= 0.42$

Question 3

let A = package A, B = package B, C = package C,
GS = good services, BS = bad services

a)



2

$P(GS|A) = 0.002$ $P(BS|A) = 1 - 0.002 = 0.998$

$P(GS|B) = 0.001$ $P(BS|B) = 1 - 0.001 = 0.999$

$P(GS|C) = 0.003$ $P(BS|C) = 1 - 0.003 = 0.997$

b) $P(GS) = P(A)P(BS) + P(B)P(BS) + P(C)P(BS)$

$= P(A)[1 - P(GS)] + P(B)[1 - P(GS)] + P(C)[1 - P(GS)]$

$= 0.20[1 - 0.002] + 0.45[1 - 0.001] + 0.35[1 - 0.003]$

$= 0.9981$ ✓

3

c) $P(B|BS) = \dfrac{P(B \cap BS)}{P(BS)}$

$= \dfrac{P(B)\,P(BS|B)}{P(GS)}$

$= \dfrac{0.45(1 - 0.001)}{0.9981}$

$= 0.4504$ ✓

Question 4

(a) X is binomial distribution. 1

(b) $P(X) = b(x; n, p) = \binom{n}{x} p^x q^{n-x}$, $x = 0, 1, 2, \ldots, n$

$P(X) = b(8; 20, 0.7)$

$= \binom{20}{8} (0.7)^8 (0.3)^{12}$ 2

$= 0.003859$

$= 0.00386$ #

(c) Banana Flavor Milk

$P(x=0) = \binom{20}{0} (0.7)^0 (0.3)^{20} = 3.48678 \times 10^{-11}$

$P(x=1) = \binom{20}{1} (0.7)^1 (0.3)^{19} = 1.627 \times 10^{-9}$

$P(x=2) = \binom{20}{2} (0.7)^2 (0.3)^{18} = 3.6068 \times 10^{-8}$

$P(x=3) = \binom{20}{3} (0.7)^3 (0.3)^{17} = 5.0496 \times 10^{-7}$

$P(x=4) = \binom{20}{4} (0.7)^4 (0.3)^{16} = 5.00755 \times 10^{-6}$

$P(x=5) = \binom{20}{5} (0.7)^5 (0.3)^{15} = 3.7389 \times 10^{-5}$

$P(x=6) = \binom{20}{6} (0.7)^6 (0.3)^{14} = 2.1811 \times 10^{-4}$

$P(x=7) = \binom{20}{7} (0.7)^7 (0.3)^{13} = 1.0178 \times 10^{-3}$

$P(x=8) = \binom{20}{8} (0.7)^8 (0.3)^{12} = 0.003859$

$P(x=9) = \binom{20}{9} (0.7)^9 (0.3)^{11} = 0.012006$

$P(x=10) = \binom{20}{10} (0.7)^{10} (0.3)^{10} = 0.03081$

$P(7 \le x \le 10) = \cancel{P(x \le 10) - P(x \le 7)}$ $P(x=7) + P(x=8) + P(x=9) + P(x=10)$

$\cancel{(x \le 10) =}$ $= (1.0178 \times 10^{-3}) + (0.003859) + (0.012006) + (0.03081)$

$= 0.0476928$

$= 0.0477$ # 8

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(d) calculate probability between 3 and 5 (inclusive) kurma flavor milk.

$$P(3 \leq x \leq 5) = P(x=3) + P(x=4) + P(x=5)$$

$$P(x=3) = \binom{20}{3}(0.3)^3(0.7)^{17}$$
$$= 0.07160$$

$$P(x=4) = \binom{20}{4}(0.3)^4(0.7)^{16}$$
$$= 0.13042$$

$$P(x=5) = \binom{20}{5}(0.3)^5(0.7)^{15}$$
$$= 0.17886$$

$$0.07160 + 0.13042 + 0.17886$$
$$= 0.38088$$

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Question 5

a i) On third try $\quad p = 0.7 \quad q = 0.3$ (11)

$$P(X = x) = (1-p)^{x-1}(p)$$

$$P(X=3) = (1-0.7)^{2}(0.7)$$

$$= 0.063$$ (2)

(ii) $P(X<4) = P(1 \leq X < 4)$

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

$$= (1-0.7)^{0}(0.7) + (1-0.7)^{2-1}(0.7) + (1-0.7)^{3-1}(0.7)$$

$$= 0.7 + 0.21 + 0.063$$

$$= 0.973$$ (6)

(iii)

$$b(X,k,p) = b(7;5;0.7)$$

$$= \binom{7-1}{5-1}(0.7)^{5}(0.3)^{7-5}$$

$$= \binom{6}{4}(0.7)^{5}(0.3)^{2}$$

$$= 2.78 \times 10^{-5}$$

$$= 0.2269$$ (3)

(b) $E(x) = np$

$n = 5 \quad p = 0.7 \quad q = 0.3$

mean = $E(x) = 5 \times 0.7$

$= 3.5$

variance = npq

$= 5 \times 0.7 \times 0.3$

$= 1.05$

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Question 6

$X \sim N(36, 0.1)$

a) $P(x < 35.8) + P(x > 36.2) = P\left(z < \frac{35.8-36}{0.1}\right) + P\left(z > \frac{36.2-36}{0.1}\right)$

$= P(z < -2) + P(z > 2)$ — 2

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

$= 2P(z < -2)$

$= 2(0.0228)$ — 3

$= 0.0456$

b) $b(0; 16, 0.0456) = \binom{16}{0}(0.0456)^0(1-0.0456)^{16-0}$

$= {}^{16}C_0 \times 0.0456^0 \times (1-0.0456)^{16-0}$ — 2½

$= 0.4739$

c) $b(1; 16, 0.0456) = \binom{16}{1}(0.0456)^1(1-0.0456)^{16-1}$

$= {}^{16}C_1 \times (0.0456)^1(1-0.0456)^{15}$ — 2½

$= 0.3623$

d) $X \sim N(37, 0.4)$

$P(x < 35.8) + P(x > 36.2) = P\left(z < \frac{35.8-37}{0.4}\right) + P\left(z > \frac{36.2-37}{0.4}\right)$ — 3

$= P(z < -3) + P(z > -2)$

$= P(z < -3) + 1 - P(z < -2)$

$= 0.0013 + (1 - 0.0228)$ — 3

$= 0.9785$

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Question 7

$X \sim N(28, 8)$

a) $P(20 < x < 40) = P\left(\frac{20-28}{8} < z < \frac{40-28}{8}\right)$

$= P(-1 < z < 1.5)$

$= 1 - P(z < -1) - P(z > 1.5)$

$= 1 - P(z < -1) - (1 - P(z < 1.5))$

$= 1 - 0.1587 - (1 - 0.9332)$

$= 0.7745$

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conclusion?

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

$= P(z < 0.25)$

$= 0.5987$

3

c) $P\left(z > \frac{x-28}{8}\right) = 0.75$

$P(z) = 1 - 0.75$

$= 0.25$

1

Since $P(z < -0.67) = 0.25$

$\therefore \frac{x-28}{8} = -0.67$

$x = 22.64$

≈ 23

∴ the number of days in which 75% of all claims are above is 23 days