SECI2143

PROBABILITY AND STATISTICAL DATA ANALYSIS

SEMESTER 2 2020/2021

ASSIGNMENT 2 :

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Question 1

$P(A) = 0.08 \rightarrow$ very easy
$P(B) = 0.29 \rightarrow$ easy
$P(C) = 0.34 \rightarrow$ average
$P(D) = 0.17 \rightarrow$ Difficult
$P(E) = 0.12 \rightarrow$ very difficult

(a) $P(C) + P(B) + P(A) = 0.34 + 0.29 + 0.08$
$$= 0.71$$

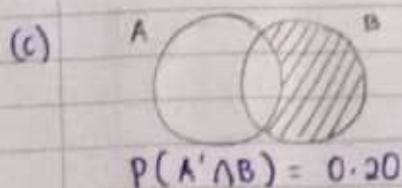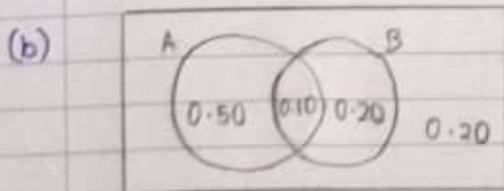(b) $P(C) + P(D) + P(E) = 0.34 + 0.17 + 0.12$
$$= 0.63$$

(c) $P(B) + P(C) + P(D) = 0.29 + 0.34 + 0.17$
$$= 0.80$$

(d) $P(D) + P(A) = 0.08 + 0.17$
$$= 0.25$$

Question 2

$P(A) = 0.60 \quad P(B) = 0.30 \quad P(A \cup B) = 0.80$

(a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$0.80 = 0.60 + 0.30 - P(A \cap B)$
$P(A \cap B) = 0.90 - 0.80$
$$= 0.10 \#$$

(b)

(c)

$P(A' \cap B) = 0.20$

(a)

$P(A' \cap B') = 0.20$

(e)

$P(A' \cup B') = 0.50 + 0.20 + 0.20$
$\qquad\qquad = 0.90$

(f)

$P(A \cap B') = 0.50$

Question 3

$P(A)$ Package A = 20%	Bad service, $P(D)$
$P(B)$ Package B = 45%	Package A = 0.002
$P(C)$ Package C = 35%	Package B = 0.001
	Package C = 0.003

Tree diagram:

Hotel

0.20 — $P(A)$ — 0.002 — $P(D) = 0.0004$
              0.998 — $P(\bar{D}) = 0.1996$

0.45 — $P(B)$ — 0.001 — $P(D) = 0.0005$
              0.999 — $P(\bar{D}) = 0.4496$

0.35 — $P(C)$ — 0.003 — $P(D) = 0.0011$
              0.997 — $P(\bar{D}) = 0.3490$
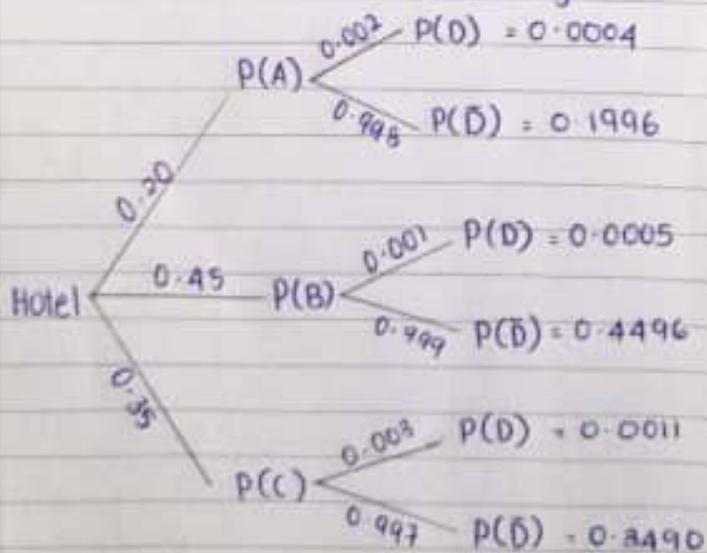
(b) $P(\bar{D}) = P(A \cap \bar{D}) + P(B \cap \bar{D}) + P(C \cap \bar{D})$

$\qquad = 0.1996 + 0.4496 + 0.3490$

$\qquad = 0.9982$ #

(c) $P(B \cap \bar{D}) = 0.45 \times 0.999$

$\qquad = 0.4496$ #

Question 4

banana milk : $P(B) = 0.7$ $n = 20$

kurma milk : $P(k) = 0.3$

a. x is a binomial random variable

b. $x = 8$ $p = 0.7$ $n = 20$ $b(x; n, p) = \binom{n}{x}(p)^x (q^{n-x})$

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

$$= 3.859 \times 10^{-3}$$

$$= 0.0039$$

c.   between 7 and 10 (inclusive) banana milk.

$7 \leq x \leq 10$ $p = 0.7$ $n = 20$

$x = 7$ $b(7; 20, 0.7) = \binom{20}{7}(0.7)^7 (0.3)^{20-7}$

$$= 0.0010$$

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

$$= 0.0039$$

$x = 9$ $b(9; 20, 0.7) = \binom{20}{9}(0.7)^9 (0.3)^{20-9}$

$$= 0.0120$$

$x = 10$ $b(10; 20, 0.7) = \binom{20}{10}(0.7)^{10} (0.3)^{20-10}$

$$= 0.0308$$

$$P(7 \leqslant x \leqslant 10) = P(7) + P(8) + P(9) + P(10)$$
$$= 0.0010 + 0.0039 + 0.0120 + 0.0308$$
$$= 0.0477$$

b.5 between 3 and 5 (inclusive) kurma milk.

$$3 \leqslant x \leqslant 5 \qquad p = 0.3 \qquad n = 20$$

$$x = 3 \qquad b(3; 20, 0.3) = \binom{20}{3} (0.3)^3 (0.7)^{20-3}$$

$$= 0.0716$$

$$x = 4 \qquad b(4; 20, 0.3) = \binom{20}{4} (0.3)^4 (0.7)^{20-4}$$

$$= 0.1304$$

$$x = 5 \qquad b(5; 20, 0.3) = \binom{20}{5} (0.3)^5 (0.7)^{20-5}$$

$$= 0.1789$$

$$P(3 \leqslant x \leqslant 5) = P(3) + P(4) + P(5)$$
$$= 0.0716 + 0.1304 + 0.1789$$
$$= 0.3809$$

Question 5

pass test · $p = 0.7$

a.
$$p(x) = (1-p)^{x-1} p$$

i. $x = 3$ $\quad p(3) = (1-0.7)^{3-1} (0.7)$

$\qquad = 0.063$

ii. $x < 4$: $x = 1$ or $x = 2$ or $x = 3$

$x = 1$ $\quad p(1) = (1-0.7)^{1-1} (0.7)$

$\qquad = 0.700$

$x = 2$ $\quad p(2) = (1-0.7)^{2-1} (0.7)$

$\qquad = 0.210$

$x = 3$ $\quad p(3) = (1-0.7)^{3-1} (0.7)$

$\qquad = 0.063$

$p(x < 4) = p(1) + p(2) + p(3)$

$\qquad = 0.700 + 0.210 + 0.063$

$\qquad = 0.973$

iii. at the 5th after 7th try

$x = 7$ $\quad r = 5$ $\quad p = 0.7$

$$p(x) = \binom{x-1}{r-1} (1-p)^{x-r} p^{r}$$

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

$\qquad = 0.2269$

6. $k = 5 \qquad p = 0.7$

$\mu = \dfrac{k}{p} \qquad\qquad \mu = \dfrac{5}{0.7}$

$= 7.143$

$= 7$

$\sigma^2 = \dfrac{k(1-p)}{p^2} \qquad \sigma^2 = \dfrac{5(1-0.7)}{(0.7)^2}$

$= 3.061$

$= 3$

6)

$\mu = 36 kg$

$\sigma = 0.1 kg$

$Z = \dfrac{x - \mu}{\sigma}$

a)

$P(x < 35.8)$ $\qquad\qquad$ $P(x > 36.2)$

$Z = \dfrac{x - \mu}{\sigma}$ $\qquad\qquad$ $Z = \dfrac{x - \mu}{\sigma}$

$\quad = \dfrac{35.8 - 36.0}{0.1}$ $\qquad\qquad$ $= \dfrac{36.2 - 36.0}{0.1}$

$\quad = -2$ $\qquad\qquad\qquad$ $= 2$
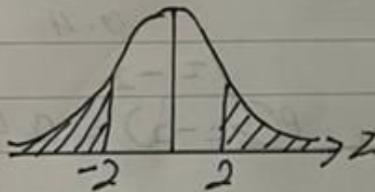
$P(Z = -2) = 0.0228$

$P(Z = 2) = 1 - 0.9772$

$\qquad\qquad = 0.0228$

$P(x < 35.8) + P(x > 36.2)$

$= 0.0228 + 0.0228 = 0.0456$

b) $n = 16$, $x = 0$, $p = 0.0456$, $q = 1 - 0.0456 = 0.9544$

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

$b(0; 16, 0.0456) = \binom{16}{0}(0.0456)^0 (0.9544)^{16-0}$

$\qquad\qquad = 0.4739$

$P(x = 0) = 0.4739$

c) $x=1$, $n=16$, $p=0.0456$, $q=1-0.0456=0.9544$

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

$b(1; 16, 0.0456) = \binom{16}{1}(0.0456)^1 (0.9544)^{16-1}$

$\qquad\qquad\qquad = 0.3623$

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

$P(x < 35.8)$

$Z = \dfrac{x - \mu}{\sigma}$

$\quad = \dfrac{35.8 - 37}{0.4}$

$\quad = -3$

$P(z = -3) = 0.0013$

$P(x > 36.2)$

$Z = \dfrac{x - \mu}{\sigma}$

$\quad = \dfrac{36.2 - 37}{0.4}$

$\quad = -2$

$P(z = -2) = 0.9772$

$P(x < 35.8) + P(x > 36.2)$

$= 0.0013 + 0.9772$

$= 0.9785$
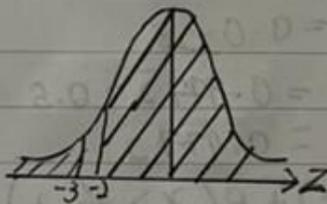
1) $\mu = 28$, $\sigma = 8$

a) $P(20 \leq x \leq 40)$

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

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

$= -1$

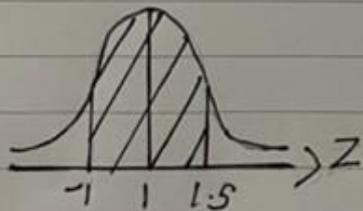$P(Z = -1) = (1 - 0.1587)$

$= 0.8413$
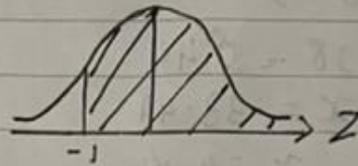
$Z = \dfrac{X - \mu}{\sigma}$

$= \dfrac{40 - 28}{8}$

$= 1.5$

$P(Z = 1.5) = 0.0668$
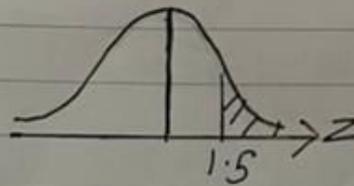
$P(20 \leq x \leq 40) = 0.8413 - 0.0668$

$= 0.7745$

b) $P(x < 30)$, $Z = \dfrac{x - \mu}{\sigma}$
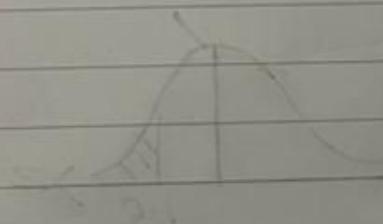
$Z = \dfrac{30 - 28}{8} = 0.25$

$P(Z = 0.25) = 0.5987$

c) $Z = \dfrac{x - \mu}{\sigma}$, $P(Z) = 0.75$

$= \left(\dfrac{x - 28}{8}\right) = 0.68$

$\quad x - 28 = 5.44$

$\qquad x = 33.44$

$\qquad \approx 34$ #