UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECI 2143-04 PROBABILITY & STATISTICAL DATA ANALYSIS – SEMESTER 2

Assignment 2

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QUESTION 1

Question 1

1. Bag 1 (Purple, Green, Yellow) (P) (G) (Y) Bag 2 (1, 2, 3, 4)

a) {(P,1), (P,2), (P,3), (P,4), (G,1), (G,2), (G,3), (G,4), (Y,1), (Y,2), (Y,3), (Y,4)}

b) Ball Alisya can take → P → 1, 2, 3 = P1, P2, P3; Y → 1, 2, 3 = Y1, Y2, Y3

c) After removing balls that Ali has took

sample space = 6

Possibility P2 = 1/6

Before removing balls that Ali has took

Sample Space = 12

Possibility P2 = 1/12

Question 1

8 computers Windows 10 (S)
10 computers Chrome (X)
10 Neither

2.

a) ∴ computers that run on windows 10 only

$25 - 10 - 10 = 5$

$P(S) = \frac{5}{25} = 0.2$

ii. computers that use google chrome only

$25 - 10 - 8 = 7$

$P(X) = \frac{7}{25} = 0.28$

iii. computer that users Neither program

$\frac{10}{25} = 0.4$

b) How many computers ran on window 10 and chrome

$25 - 10 = 15$

c) How many computers that ran on windows 10 and chrome

computers windows 10 only = 5
computers chrome only = 7

$5 + 7 = 12$

$P(S \cap X) = 15 - 12 = 3$

d) computers that ran on windows 10 only

= 5 computers

Question 1

3. 12 male 18 female

3 male + 5 female = Bahamas

a) P(Bahamas) = $\frac{3+5}{12+18} = 0.267$

b) P(male given that from Bahamas) = $\frac{3}{30}$ #

$P(M|B) = \frac{P(M \cap B)}{P(B)}$ # = $\frac{3/30}{6/30} = 3/8 = 0.375$ #

$P(m \cap B) = \frac{3}{30}$

$P(B) = \frac{8}{30}$

c) $P(m \cup B) = P(m) + P(B)$

$= \frac{12}{30} + \frac{8}{30}$

$= \frac{20}{30} = 0.67$

QUESTION 2

Question 2

1. a) $P(X=2) = 3/8 = 0.375$

b) $P(X \geq 2) = 3/8 + 1/8 = 4/8 = 1/2 = 0.5$

c) $P(X \leq 2) = 1/8 + 3/8 + 3/8 = 7/8 = 0.875$

d) $P(X=3)$ or $P(X=0) = 1/8 + 1/8 = 2/8 = 0.25$

2. a) $P(X \geq 10) = 0.05 + 0.12 + 0.06 = 0.23$

b) $P(X > 10) = 0.12 + 0.06 = 0.18$

c) $P(x < 4) = 0.11 + 0.07 = 0.18$

d) $P(X \geq 4)$ and $P(X \leq 9) = (0.13 + 0.28 + 0.18 + 0.05 + 0.12 + 0.06) \cdot (0.11 + 0.07 + 0.13 + 0.28 + 0.18)$

$= 0.82 \cdot 0.77$

$= 0.6314$

e) $P(X > 3)$ and $P(X < 10) = (0.13 + 0.28 + 0.18 + 0.05 + 0.12 + 0.06) \cdot (0.11 + 0.07 + 0.13 + 0.28 + 0.18)$

$= 0.82 \cdot 0.77$

$= 0.6314$

f) $P(7 < x < 9) = \frac{(0.28 + 0.18)}{2}$

$= 0.23$

No. Date

3. a) $P(X \geq 1) = 0.1 + 0.2 + 0.25 + 0.15 + 0.1 + 0.05$

$= 0.95$ #

b) $P(X \geq 3) = 0.25 + 0.15 + 0.1 + 0.05$

$= 0.55$ #

c) $P(X \leq 5) = 0.05 + 0.1 + 0.3 + 0.25 + 0.15 + 0.1$

$= 0.95$ #

d) $P(2 \leq X < 4) = 0.3 + 0.25$

$= 0.55$ #

e) $P(X = \text{even number}) = 0.05 + 0.3 + 0.15 + 0.05$

$= 0.55$ #

QUESTION 3

Question 3

1 (a) Binomial distribution.

(b) $P(X) = 0.02$

$P(X>1) = P(X) - P(X=1) - P(X=0)$

$P(X=0) = 50C0\,(0.02)^0\,(1-0.02)^{50}$

$= 0.364$

$P(X=1) = 50C1\,(0.02)^1\,(1-0.02)^{49}$

$= 0.371$

$P(\text{reject}) = 1 - 0.371 - 0.364$

$= 0.265$

2. 60% → folding bike

40% → mountain bike.

$n \rightarrow 12$

(a) $P(X=4) = 12C4\,(0.6)^4\,(1-0.6)^{12-4}$

$= 0.042$

2. b) ~~$P(X=0) + P(X=1) + P(X=2) + P(X=3)$~~

$P(4 \leq X \leq 7) = P(X=4) + P(X=5) + P(X=6) + P(X=7)$

$P(X=4) = 0.042$

$P(X=5) = {}^{12}C_5 (0.6)^5 (1-0.6)^{12-5} = 0.101$

$P(X=6) = {}^{12}C_6 (0.6)^6 (1-0.6)^{12-6} = 0.177$

$P(X=7) = {}^{12}C_7 (0.6)^7 (1-0.6)^{12-7} = 0.227$

$P(X) = 0.042 + 0.101 + 0.177 + 0.227 = 0.547$

c) $P(X=2) = {}^{12}C_2 (0.4)^2 (1-0.4)^{12-2} = 0.064$

Question 3

3. a) $P(x) = 0.25$ → make mistake

$P(x) = 0.75$ → Not mistake

$P(3 \leq x \leq 6) = P(x=3) + P(x=4) + P(x=5) + P(x=6)$

$P(x=3) = {}^{15}C_3 (0.25)^3 (1-0.25)^{15-3} = 0.2251$

$P(x=4) = {}^{15}C_4 (0.25)^4 (1-0.25)^{15-4} = 0.2252$

$P(x=5) = {}^{15}C_5 (0.25)^5 (1-0.25)^{15-5} = 0.1651$

$P(x=6) = {}^{15}C_6 (0.25)^6 (1-0.25)^{15-6} = 0.0917$

$0.2251 + 0.2252 + 0.1651 + 0.0917 = 0.7072$ ✱

b) $P(x \leq 4) = P(x=0) + P(x=1) + P(x=2) + P(x=3)$

$P(x=0) = {}^{15}C_0 (0.25)^0 (1-0.25)^{15-0} = 0.0134$

$P(x=1) = {}^{15}C_1 (0.25)^1 (1-0.25)^{15-1} = 0.0668$

$P(x=2) = {}^{15}C_2 (0.25)^2 (1-0.25)^{15-2} = 0.1559$

$P(x=3) = {}^{15}C_3 (0.25)^3 (1-0.25)^{15-3} = 0.2251$

$0.0134 + 0.0668 + 0.2251 + 0.1559 = 0.4613$ ✱

c)

$P(x>5) = 1 - [P(x=0) + P(x=1) + P(x=2) + P(x=3) + P(x=4)]$

$P(x=4) = {}^{12}C_4 (0.25)^4 (1-0.25)^{12-4} = 0.1936$

$1 - 0.4613 + 0.1936 = 0.3451$

✱

QUESTION 4

Question 4

1. a) 20 % chance = 0.20 1st penetrate on 3rd piled?

using geometric distribution formula :

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

$$P(x=3) = (1-0.20)^{3-1} (0.20)$$

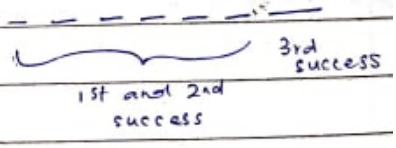
$$= 0.128$$

b) 3rd penetrate on 7th piled.

3 success 4 fail

p = success q = not success

p = 0.20 q = 0.80



$$6 \cdot (0.20)^3 \cdot (0.80)^4 = 0.0197$$

c) mean = $\frac{1}{p}$ variance = $\frac{(1-p)}{p^2}$

$= \frac{1}{0.20}$ $= \frac{(1-0.20)}{0.20^2}$

$= 5$ $= 20$

No. Date

2. a) It is geometric distribution because the trial will resulting success and fail. It is infinite probability until the first success occurs.

b) X represent the number the number of participants that I ask.

c) $40\% = 0.40$ $p = 0.4$ $q = 1 - p = 0.6$

$P(x) = q^x p$

$P(X=1) = 0.6^{1-1}(0.4)$

$= 0.4$

d) $P(x \leq 3) = P(x=1) + P(x=2) + P(x=3)$

$= 0.4 + (0.6^1(0.4)) + (0.6^2(0.4))$

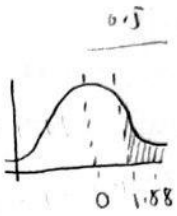
$= 0.4 + 0.24 + 0.144$

$= 0.784$

QUESTION 5

Question 5

1. $X \sim N(163, 8)$



(a) $P(X \geq 178)$

$$z = \frac{x - \mu}{\sigma}$$

$$= \frac{178 - 163}{8}$$

$$= 1.875$$

$P(z \geq 1.88)$

$= 0.5 - 0.4699$

$= 0.0301$

* Percentage $= (0.0301 \times 100\%)$

$= 3.01\%$

(b) $\frac{3.01}{100} \times 5000 = 150.5 \approx 151$ candidate

(c) $P(Z \geq z_0) = 0.17$

$P(Z \geq 0.95) = 0.17$

$z_0 = 0.95$

$$z_0 = \frac{x_0 - \mu}{6}$$

$$0.95 = \frac{x_0 - 163}{8}$$

$x_0 = 170.6$ cm

No.: Date:

2. $n = 180$

$p = 0.21$

$\mu = 180 \times 0.21 = 37.8$

$\sigma = \sqrt{37.8(1-0.21)} = 5.46$

$X \sim (37.8, 5.46)$

(a) $P(X = 30)$ $\quad P(z = 1.43)$

$= 0.4236$

$Z = \frac{30 - 37.8}{5.46}$

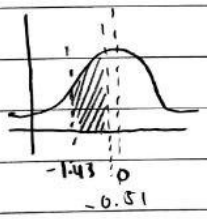
$= -1.43$

(b) $P(30 \leq X \leq 35)$

$P(X \geq 30)$

$Z = \frac{30 - 37.8}{5.46}$

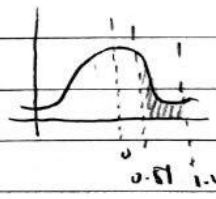
$= -1.43$



$P(X \leq 35)$

$Z = \frac{35 - 37.8}{5.46}$

$= -0.51$



$\therefore P(0.51 \leq z \leq 1.43)$

$= 0.4236 - 0.1950$

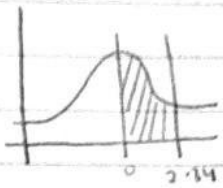
$= 0.2286.$

No.: Date:

(c) $P(x \geq 25)$

$$z = \frac{25 - 37.8}{5.46}$$

$$= -2.34$$



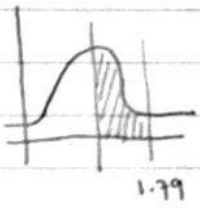
$$P(z = 2.34) = 0.5 + 0.4904$$

$$= 0.9904$$

(d) $P(x \leq 28)$

$$z = \frac{28 - 37.8}{5.46}$$

$$= -1.79$$



$$P(z = 1.79) = 0.5 - 0.4633$$

$$= 0.0367$$

3. $X \sim N(2.50, 0.83)$

(a) $P(X > 5)$

$= 1 - P(X < 5)$

$z = \dfrac{5 - 2.50}{0.83}$

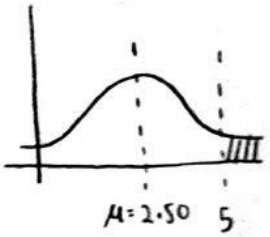
$= 3.01$

$= 1 - P(z < 3.01)$

$= 1 - 0.9987$

$= 0.0013$

* sketch of the standard normal density for the proportion of individuals with this condition.



(b) Required probability = 0.0013

(c) $X \sim N(3, 1.5)$

$P(X < 1.47)$

$= 1 - P(X > 1.47)$

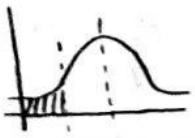
$z = \dfrac{1.47 - 3}{1.5}$

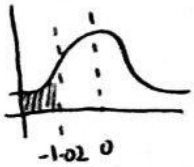
$= -1.02$

$= 1 - P(z > -1.02)$

$= 1 - 0.8461$

$= 0.1539$





Percentage $= (0.1539 \times 100\%) = 15.39\%$