PROBABILITY & STATISTICAL DATA ANALYSIS

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SECI2143

Lecturer:

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Question 1

Question 1

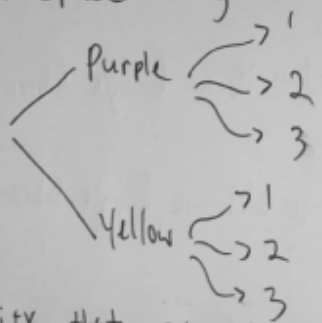
1. → One bag has 3 color balls (PURPLE, GREEN, YELLOW)
→ One bag has 4 balls number (1, 2, 3, 4)

a) All the posible combination of TWO Balls Ali can take?

$$3C_1 \times 4C_1$$

$$= \frac{3!}{2! \cdot 1!} \times \frac{4!}{3! \cdot 1!} = \frac{4!}{2!} = \frac{4 \cdot 3 \cdot 2}{2} = 12$$

b) After Ali took the ball (Green & 4)
First bag has 2 remaining (Purple, Yellow)
Other bag has 3 remaing (1, 2, 3)
→ Possible combination of two balls Alisya take
Purple-1, Yellow-1
Purple-2, Yellow-2
Purple-3, Yellow-3
→ Sample Space using tree diagram:



(c) Probability that colored ball is PURPLE and ball number 2

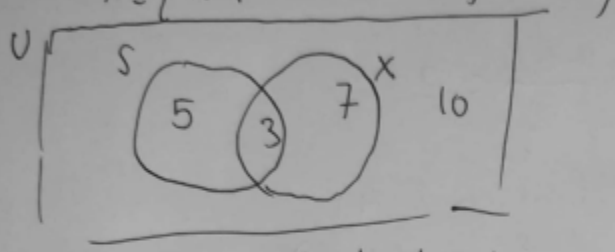
$$= \frac{1}{12} = 0.0833$$

Question 2

- 25 computers in Computer lab
-> 8 computers = Windows 10
-> 10 computers: Google Chrome as browser
-> 10 computers use neither of the program

S = { computers with windows 10 }

X = { computers with Google chrome }



a) i. Computers run Windows 10 only

$\frac{8}{25}$

ii. Computers use Google chrome only

$\frac{10}{25} = \frac{2}{5}$

iii. Computers use neither program

$\frac{10}{25} = \frac{2}{5}$

b) How many computers either ran Windows 10 or Google Chrome?

$7 + 3 + 5 = 15$

c) How many computers ran Windows 10 and use Google Chrome?

3

d) Computer ran Windows 10 but didnt use Google Chrome?

5

3.1 → Total number of tourists = 12 Male, 18 Female = 30 total

→ Total number of tourist from Bahamas = 3 Male, 5 Female = 8 total

a) Probability of selecting a tourist from Bahamas.

→ ~~Number~~ Probability of selecting single tourist from Bahamas:

$$8C_1 = \frac{8!}{7!\,1!} = \frac{8 \cdot 7!}{7!} = 8$$

→ Probability selecting single tourist from group:

$$30C_1 = \frac{30!}{29!\,1!} = \frac{30 \cdot 29!}{29!} = 30$$

↳ $$\frac{8C_1}{30C_1} = \frac{8}{30} = \frac{4}{15} = 0.27$$

b) Probability of selecting a male tourist given tourist from Bahamas

→ Selecting male tourist from Bahamas

$$3C_1 = \frac{3!}{2!\,1} = \frac{3 \cdot 2!}{2!} = 3$$

→ Selecting single tourist from Bahamas

$$8C_1 = \frac{8!}{7!\,1} = \frac{8 \cdot 7!}{7!} = 8$$

↳ $$\frac{3C_1}{8C_1} = \frac{3}{8} = 0,375$$

c) Probability of selecting either a male or tourist from Bahamas.

-> Total number of Male Tourist: 12

-> Total number of Female Tourist(Bahama) = 5

-> Total number of Male Tourists + Total number of Female tourist(Bahama)
= 17

- Selecting a single tourist from [total male tourist + Female from Bahama]

$$17C_1 = \frac{17!}{16! \cdot 1} = 17$$

- Selecting single tourist from group:

$$30C_1 = \frac{30 \cdot 29!}{29! \cdot 1} = 30$$

$$\frac{17}{30} = 0.57$$

Question 2

No.: ..... Date: .....

Question 2

1- Let number of baby girl born per day as x where $\{x = 0, 1, 2, 3\}$

X	$P(X = x)$
0	$1/8$
1	$3/8$
2	$3/8$
3	$1/8$

a) Probability for the birth when we have exactly two girls.

$$\therefore P(X = 2) = \frac{3}{8}$$

b) Probability for the birth when we have at least two girls.

$$P(x \geq 2) = P(x = 2) + P(x = 3)$$
$$= 3/8 + 1/8$$
$$= 4/8$$
$$= 1/2$$

c) Probability for the birth when we have at most two girls.

$$P(x \leq 2) = P(x = 0) + P(x = 1) + P(x = 2)$$
$$= 1/8 + 3/8 + 3/8$$
$$= 7/8$$

d) Probability for the birth when we have all or no girl were born.

$$= P(x = 3) + P(x = 0)$$
$$= 1/8 + 1/8$$
$$= \frac{2}{8}$$
$$= 1/4$$

No.: ..... Date: .....

2-

x	1	3	4	7	9	10	14	18
$P(X=x)$	0.11	0.07	0.13	0.28	0.18	0.05	0.12	0.06

What is the probability that:

a- X is at least 10? $P(x \geq 10) = P(x=10) + P(x=14) + P(x=18)$

$= 0.05 + 0.12 + 0.06$

$= 0.23$

b- X is more than 10? $P(x > 10) = P(x=14) + P(x=18)$

$= 0.12 + 0.06$

$= 0.18$

c- X is less than 4? $P(x < 4) = P(x=1) + P(x=3)$

$= 0.11 + 0.07$

$= 0.18$

d- X is at least 4 and at most 9? $P(4 \leq x \leq 9) = P(x=4) + P(x=7) + P(x=9)$

$= 0.13 + 0.28 + 0.18$

$= 0.59$

e- X is more than 3 and less than 10? $P(3 < x < 10) = P(x=4) + P(x=7) + P(x=9)$

$= 0.13 + 0.28 + 0.18$

$= 0.59$

f - X is between 7 and 9?

~~Not valid, because there is no probability for x is between 7 and 9.~~

The probability is 0.00, because there is no value between 7 and 9 for X.

No.: Date:

3.

# of friends/family	0*	1	2	3	4	5	6
Probability	0.05	0.1	0.3	0.25	0.15	0.1	0.05

*0 means the guest came alone (did not bring any friends/family members)

Find the probability that the guest brings:

a - at least one friend/family member. $P(x \geq 1) = P(x=1) + P(x=2) + P(x=3) + P(x=4) + P(x=5) + P(x=6)$

$= 0.1 + 0.3 + 0.25 + 0.15 + 0.1 + 0.05$

$= 0.95$

b - at least three friends/family members. $P(x \geq 3) = P(x=3) + P(x=4) + P(x=5) + P(x=6)$

$= 0.25 + 0.15 + 0.1 + 0.05$

$= 0.55$

c - at most five friends/family members. $P(x \leq 5) = P(x=0) + P(x=1) + P(x=2) + P(x=3) + P(x=4) + P(x=5)$

$= 0.05 + 0.1 + 0.3 + 0.25 + 0.15 + 0.1$

$= 0.95$

d - at least two and not more than four friends/family members.

$P(2 \leq x < 4) = P(x=2) + P(x=3)$

$= 0.3 + 0.25$

$= 0.55$

e - an even number of friends/family members.

$P(x = \text{Even}) = P(x=0) + P(x=2) + P(x=4) + P(x=6)$

$= 0.05 + 0.3 + 0.15 + 0.05$

$= 0.55$

Question 3

Question 3

1. a) i. probability distribution of x
- binomial

ii. $P(\text{order rejected}) = P(x > 1)$

$= 1 - P(x \leq 1)$

$= 1 - [P(x=0) + P(x=1)]$

$= 1 - [{}^{50}C_0 (0.02)^0 (0.98)^{50} + {}^{50}C_1 (0.02)(0.98)^{49}]$

$= 1 - (0.364 + 0.371)$

$= 0.265$

b) $P(X = x) = \dfrac{\lambda^x e^{-\lambda}}{x!}, \quad \lambda = 20$

$P(x \geq 3) = 1 - [P(x=0) + P(x=1) + P(x=2)]$

$= 1 - \left[\dfrac{20^0 e^{-20}}{1} + \dfrac{20 e^{-20}}{1} + \dfrac{20^2 e^{-20}}{2}\right]$

$= 1 - e^{-20}(1 + 20 + 200)$

$= 1 - e^{-20}(221)$

$= 0.99999544$

2. a) $P(x=4) = {}^{12}C_4 (0.60)^4 (0.40)^8 = 0.0420$

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

$= {}^{12}C_4 (0.60)^4 (0.40)^8 + {}^{12}C_5 (0.60)^5 (0.40)^7 + {}^{12}C_6 (0.60)^6 (0.40)^6$

$+ {}^{12}C_7 (0.60)^7 (0.40)^5$

$= 0.0420 + 0.1009 + 0.1766 + 0.2270$

$= 0.5465$

c) $P(x=2) = {}^{12}C_2 (0.40)^2 (0.60)^{10} = 0.0639$

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

$= {}^{15}C_3 (0.25)^3 (0.75)^{12} + {}^{15}C_4 (0.25)^4 (0.75)^{11} +$
$\quad {}^{15}C_5 (0.25)^5 (0.75)^{10} + {}^{15}C_6 (0.25)^6 (0.75)^9$

$= 0.2252 + 0.2252 + 0.1651 + 0.0917$

$= 0.7072$

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

$= {}^{15}C_0 (0.25)^0 (0.75)^{15} + {}^{15}C_1 (0.25)(0.75)^{14} +$
$\quad {}^{15}C_2 (0.25)^2 (0.75)^{13} + {}^{15}0.2252$

$= 0.0134 + 0.0668 + 0.1559 + 0.2252$

$= 0.4613$

c) $P(x>5) = 1 - P(x \leq 4)$

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

$= 1 - [0.4613 + 0.2252]$

$= 1 - 0.6865$

$= 0.3135$

Question 4

Date :

Question 4 :

1.a) $p = 0.2 \quad q = 0.8$

$P(X=3) = (0.8)^2(0.2)$

$= 0.128$

b) 3rd penetrate at 7th try.

First 6 random → ${}^6C_2(0.2)^2(0.8)^4 = 0.24576$

Then, $0.24576 \times 0.2 = 0.049152$

c) Mean $\Rightarrow \mu = \frac{1}{p} = \frac{1}{0.2} = 5$

Variance $\Rightarrow \sigma^2 = \left(\sqrt{\frac{(1-p)}{p^2}}\right)^2$

$= \left(\sqrt{\frac{(1-0.2)}{(0.2)^2}}\right)^2 = 20$

Date :

Question 4:

2. a) This is a Geometric experiment as we are attempting for success to find a charger until we find one from the candidates.

b) Random variable X represent the total number of trials up to and including the first success.

c) $p = 40\% = 0.4$
$q = 60\% = 0.6$

$P(X = 1) = 0.4$ #

d) $P(X \leq 3)$:
$= 1 - (1 - 0.4)^3$
$= 0.784$ #

Question 5

No.: Date:

Question 5

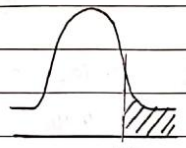
1) mean $= \mu = 163$, standard deviation $= \sigma = 8$, $n = 5000$ candidates

a) $P(x \geq 178)$

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

$= 1.875$

$= 1.88$



$\therefore$ From z table

$P(z = 1.88) = 1 - 0.9699$

$= 0.0301$

$\therefore$ Percentage $= 0.0301 \times 100$

$= 3.01\%$

b) Number of candidates that are eligible $= 5000 \times 0.0301$

$= 150.5$

$= 150$ candidates

c) Percentage $= 17\%$

$\therefore P(z = y) = \frac{17}{100}$

$= 0.17$

From z table: $y = 0.44$

$\therefore P(z = 0.44) = 0.17$

$z = 0.44$

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

$0.44 = \frac{x - 163}{8}$

$x = 166.52$

$\therefore$ New height requirement is 166.52 cm

No.: Date:

2- Let p = no-show rate for reservation

$\therefore p = 0.21$, $q = 1 - p$, $n = 180$

$= 1 - 0.21$

$= 0.79$

a) $\mu = np = 180(0.21)$ $\sigma = \sqrt{npq} = \sqrt{180(0.21)(0.79)}$

$= 37.8$ $= 5.4646$

$\therefore P(x = 30)$ Based on half z table,

$z = \frac{30 - 37.8}{5.4646}$ $P(z = 1.43) = 0.4236$

$= -1.43$

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

For $P(x \geq 30)$

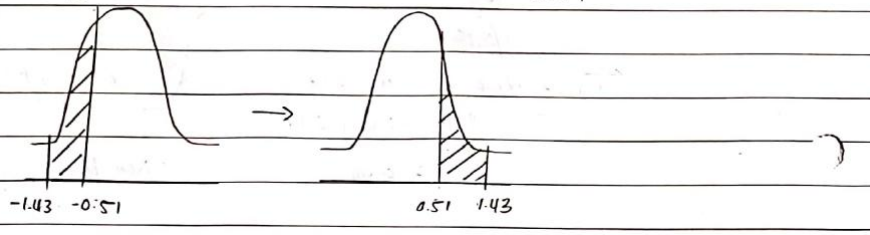
$z = \frac{30 - 37.8}{5.4646}$

$= -1.43$

For $P(x \leq 35)$

$z = \frac{35 - 37.8}{5.4646}$

$= -0.51$



$\therefore P(0.51 \leq z \leq 1.43) = 0.4236 - 0.1950$

$= 0.2286$

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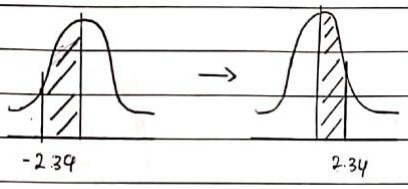
2 - c) $P(x \geq 25)$

$\therefore z = \frac{25 - 37.8}{5.4646}$

$= -2.34$



∴ From half z table

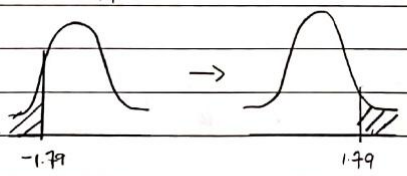
$P(z = 2.34) = 0.5 + 0.4904$

$= 0.9904$

d) $P(x \leq 28)$

$\therefore z = \frac{28 - 37.8}{5.4646}$

$= -1.79$



∴ From half z table

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

$= 0.0367$

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3- Mean $= \mu = 2.50$, Standard deviation $= \sigma = 0.83$

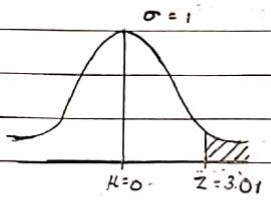
a) $X = 5.00$

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

$= \frac{5.00 - 2.50}{0.83}$

$= 3.012$

$= 3.01$



b) From 3a, $Z = 3.01$

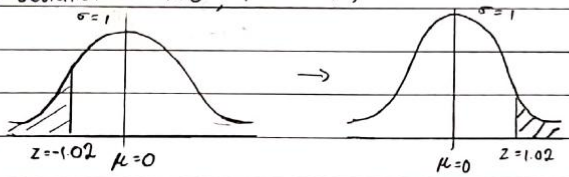
$P(Z = 3.01) = 0.5 - 0.4987$

$= 0.0013$

c) Mean $= \mu = 3.00$, standard deviation $= \sigma = 1.50$, $P(x < 1.47)$

$\therefore Z = \frac{1.47 - 3.00}{1.50}$

$= -1.02$



$\therefore Z = 1.02$

$\therefore P(Z = 1.02) = 0.5 - 0.3461$

$= 0.1539$

$\therefore$ Percentage $= 0.1539 \times 100$

$= 15.39\ \%$