HOME WORK #1
Ex: 5

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Q#5.4

Discrete Random Variable:- (Stochastic Variable)
A variable that is determined by the outcome of a random experiment can assumed any value contained in one or more intervals Also known as stochastic variable

Probability Distribution of Discrete Random Variable:-
List of all pocible values that the random variable can acume and their corresponding probabilites

Eg: Example of Probability Distribution Table.

Number Of Vehicles	Frequency	Relative Frequency
0	30	30/2000 = .015
1	320	320/2000 = 0.160
2	910	0.455
3	580	0.290
4	160	0.80
	N = 2000	Sum = 1.00

Q# 5.5

The two Characteristics of Probability distributions of a discrete random variable are:

1) $0 \leq P(x) \leq 1$
2) $\Sigma P(x) = 1$

Q # 5.6

(a) Valid because $\sum P(x)$

(b) Not Valid $\sum P(x) = 0.97$ it should be $\sum P(x) = 1$

(c) $\sum P(x) = 1$ Valid but $P(7)$ has negative probability.

Q # 5.7

(a) $P(3) = \boxed{0.15}$

(b) $P(0) = 0.11$
$P(1) = 0.19$
$P(2) = 0.28$

$P(0) + P(1) + P(2) = 0.11 + 0.19 + 0.28 = \boxed{0.58}$

(c) $P(4) + P(5) + P(6) = 0.12 + 0.09 + 0.06 = \boxed{0.27}$

(d) $P(1) + P(2) + P(3) + P(4) = 0.19 + 0.28 + 0.15 + 0.12 = \boxed{0.74}$

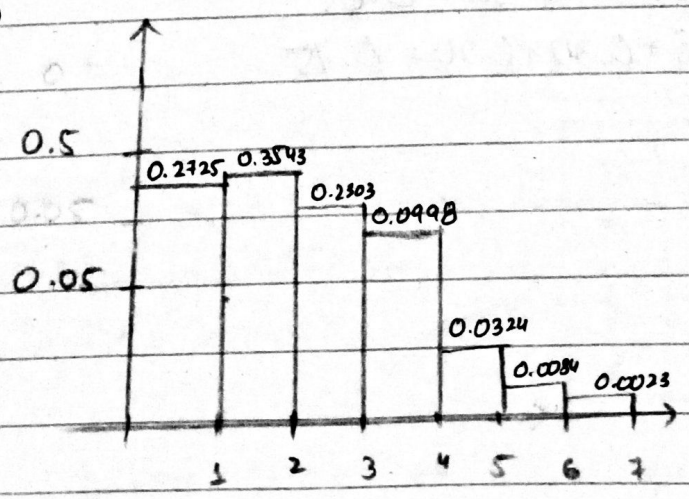
(e) $x < 4$
$P(0) + P(1) + P(2) + P(3) = 0.11 + 0.19 + 0.28 + 0.15 = \boxed{0.73}$

(f) $x > 2$
$P(3) + P(4) + P(5) + P(6) = 0.15 + 0.12 + 0.09 + 0.06 = \boxed{0.42}$

(g) $2 \leq x \leq 5$
$P(2) + P(3) + P(4) + P(5) = 0.28 + 0.15 + 0.12 + 0.09 = \boxed{0.64}$

Q # 5.8

(a)



(b) (i) $x \geq 2$

$P(2) + P(3) + P(4) + P(5) + P(6)$

$= 0.2303 + 0.0998 + 0.0324 + 0.0084 + 0.0023$

$= 0.37320$

(ii) $x = 5 \quad P(5) = 0.0084$

(iii) $x < 3 \quad P(0) + P(1) + P(2) = 0.2725 + 0.3543 + 0.2303$

$= 0.85710$

(iv) $x < 1 \quad P(0) + P(1) = 0.2725 + 0.3543 = 0.62680$

Q# 5.9 (a)

x	$P(x)$
1	0.1
2	0.25
3	0.30
4	0.20
5	0.15

(b) Approximate, because data has only been collected from the last 80 days (sample)

(c) $P(3) = 0.3$

$P(x \geq 3) = 0.15 + 0.20 + 0.30 = 0.65$

$P(2 \leq x \leq 4) = 0.25 + 0.30 + 0.20 = 0.75$

$P(x < 4) = 0.65$

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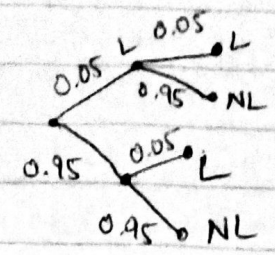
Q5.10



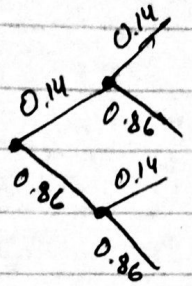
L = lemon

NL = Not lemon

$\Sigma P(x) =$

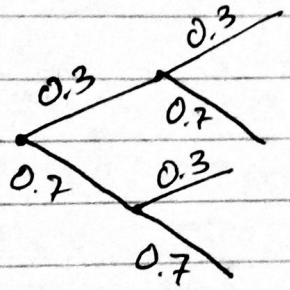
x	P(x)
0	0.9025
1	0.0950
2	0.0025
	$\Sigma P(x) = 1.0$

Q5.11



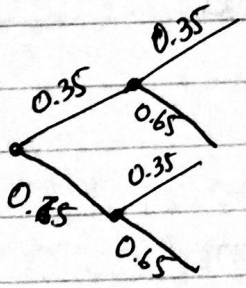
x	P(x)
0	0.7396
1	0.2408
2	0.0196

Q5.12



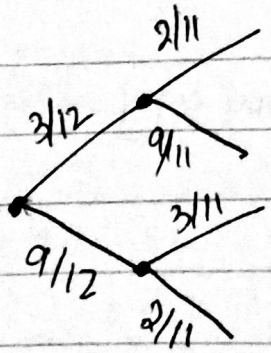
x	P(x)
0	0.49
1	0.42
2	0.09

Q5.13



x	P(x)
0	0.4225
1	0.4450
2	0.1225

Q5.14



x	P(x)
0	0.5454
1	0.40920
2	0.0454

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Q16 (a) $\Sigma x P(x) = 1.59$

$\sqrt{(\Sigma x^2 (P(x)) - \mu^2} \cdot \sqrt{3.45 - (1.59)^2} = 0.96016$

∴ (a) Mean = 1.59 Std Dev = 0.96016

(b) Mean = $\Sigma x P(x) = 7.07$

Std Dev = $\sqrt{\Sigma x^2 P(x) - \mu^2}$

$= \sqrt{51.11 - (7.07)^2}$

$= \sqrt{1.06071}$

Q17 $\Sigma x P(x) = 0.44$

Mean = 0.44 errors

Std Dev = $\sqrt{0.92 - (0.44)^2}$

$= \sqrt{0.85229}$ errors.

Q18

$\mu = \Sigma x P(x) = 2.94$

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2}$

$= \sqrt{10.72 - (2.94)^2} = 1.44097$ Cams Sold

Q19 $\mu = \Sigma x P(x) = 1.2997$ patients

$\sigma = \sqrt{\Sigma x^2 P x - \mu^2} = 1.13828$ patients

Q20 $\mu = \Sigma x P(x) = 2.48$ houses Sold

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2} = 1.29985$ houses sold

Q21

$\mu = \Sigma x P(x) = 2.561$

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2} = 1.32245$

Q22

$\mu = \Sigma x P(x) = 3.05$

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2} = 1.20312$

Q23

$\mu = \Sigma x P(x) = 3.9$ $ million

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2} = 3.015$ $ million

Q24

x	P(x)
-2	0.8894
3	0.1
8	0.01
998	0.0005
4998	0.0001

$\mu = \Sigma x P(x) = -0.4$ $

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2}$

$= 54.78084$ $

Q25

$\mu = \Sigma x P(x) = 0.5$

$\sigma = \sqrt{\Sigma x^2 P(x) - \mu^2} = 0.584$

Q28

(a) NO, number of outcomes ! =2 since there are 6 possible outcomes

(b) Yes, it satisfied all 4 condition of bionomial distribution

(c) Yes.

Q29

(a) Yes

(b) NO, trials are dependent

(c) Yes

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Q30

(a) $P(x) = {}_nC_x\, p^x q^{n-x}$ $\quad p = 0.7$, $q = 0.3$

$n = 8$, $x = 5$, $n - x = 3$

$P(5) = {}_8C_5\, p^5 q^3 = {}_8C_5 (.7)^5 (.3)^3$

$= 0.25412$

(b) $P(3) = {}_4C_3 (.4)^3 (.6)^1$

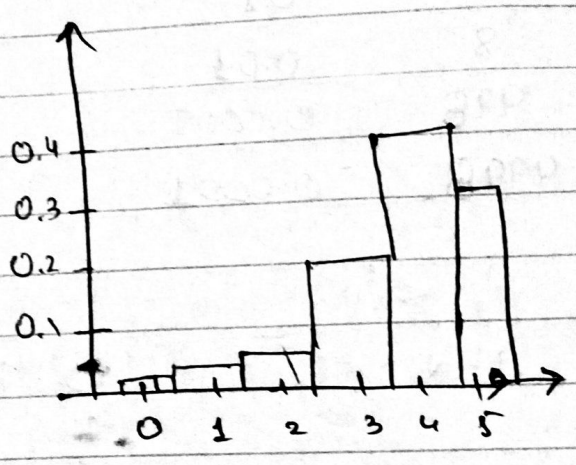
$= 0.1536$

(c) $P(2) = {}_6C_2 (.3)^2 (.7)^4$

$= 0.32413$

Q31

x	P(x)
0	0.0003
1	0.0064
2	0.0512
3	0.2048
4	0.4096
5	0.3277

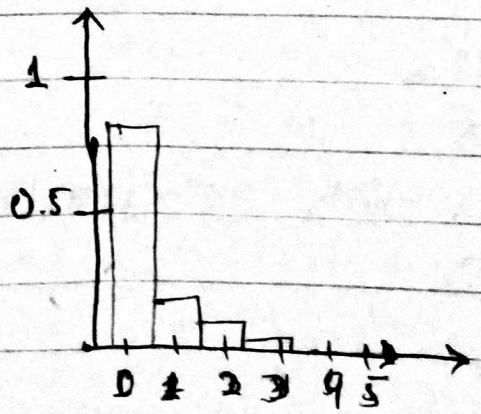


$\mu = np = 5(0.8) = 4$

$\sigma = \sqrt{npq} = \sqrt{(5)(0.8)(0.2)} = 0.89443$

Q32 for $n = 5$, $P = 0.05$

x	P(x)
0	0.7738
1	0.2036
2	0.0214
3	0.011
4	0.00
5	0.00



(7)

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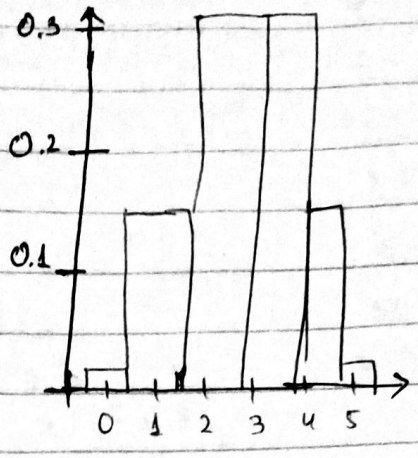
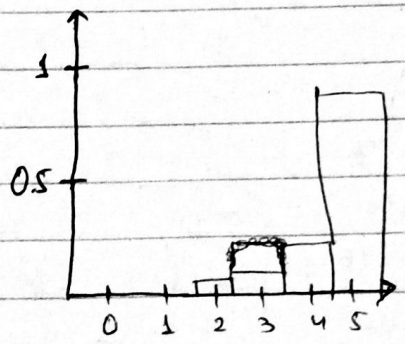
$n = 5$, $P = 0.5$

x	$P(x)$
0	0.0312
1	0.1562
2	0.3125
3	0.3125
4	0.1562
5	0.0312



$n = 5$, $P = 0.95$

x	$P(x)$
0	0.0
1	0.0
2	0.0011
3	0.0214
4	0.2036
5	0.7738



Q38 (a) $P(8) = {}_8C_8 (0.85)^8 (0.15)^0$

$= 0.27249$

(b) $P(5) = {}_8C_5 (0.85)^5 (0.15)^3$

$= 0.08386$

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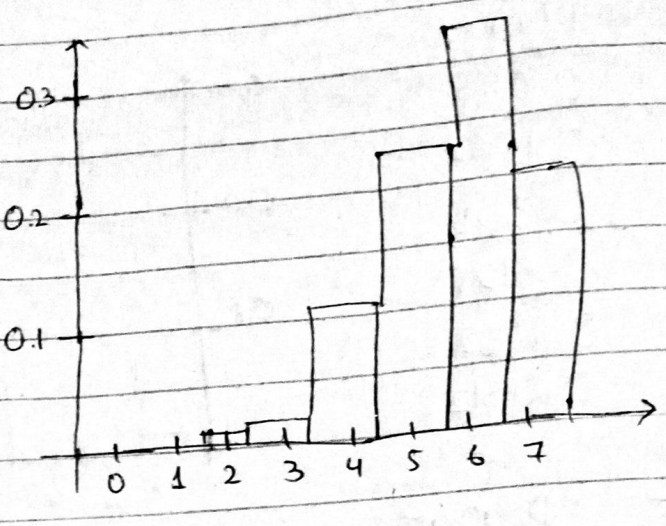
039

x	P(x)
0	0.0000
1	0.0064
2	0.0043
3	0.0287
4	0.1147
5	0.2753
6	0.3670
7	0.2097



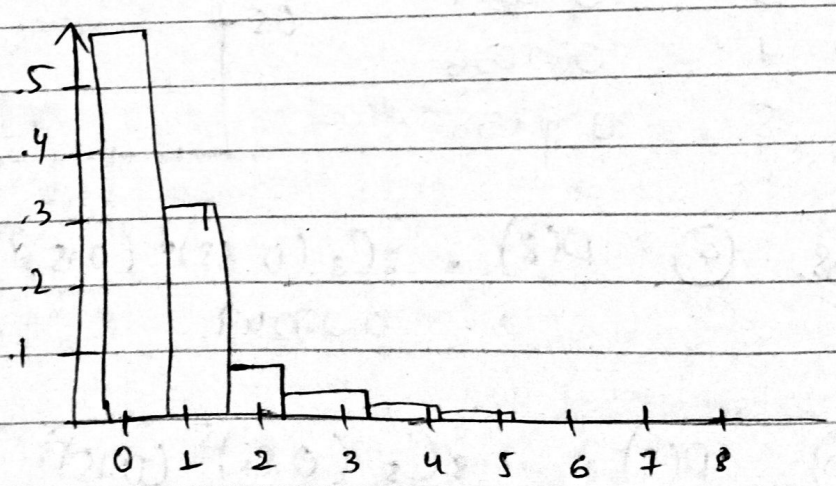
$\mu = np = (7)(0.8) = 5.6$ customers

$\sigma = \sqrt{npq} = \sqrt{(7)(0.8)(0.2)} = 1.058$ customers

$P(4) = 0.1147$

040

x	P(x)
0	0.5987
1	0.3151
2	0.0746
3	0.0105
4	0.0010
5	0.0001
6	0.0000
7	"
8	"
9	"
10	"



$\mu = np = (10)(0.05) = 0.5$

$\sigma = \sqrt{npq} = \sqrt{10(0.05)(0.95)}$

$= 0.68920$

(b) 0.0746

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Q42

$$P(x) = \frac{{}_rC_x \cdot {}_{n-r}C_{n-x}}{{}_NC_n}$$

(a) $P(2) = \frac{{}_3C_2 \cdot {}_5C_2}{{}_8C_4} = 0.42857$

(b) $P(0) = \frac{{}_3C_0 \cdot {}_5C_4}{{}_8C_4} = 0.07143$

(c) $P(x \leq 1) = P(0) + P(1)$

$= 0.5 + \frac{{}_3C_1 \cdot {}_5C_3}{{}_8C_4} = 0.92857$

Q43

(a) $P(2) = \frac{{}_4C_2 \cdot {}_7C_2}{{}_{11}C_4} = 0.3818$

(b) $P(4) \quad \frac{{}_4C_4 \cdot {}_7C_0}{{}_{11}C_{11}} = 0.0030$

(c) $P(x \leq 1) \quad \frac{{}_4C_0 + {}_7C_4}{{}_{11}C_4} + \frac{{}_4C_1 + {}_7C_3}{{}_{11}C_4} = 0.5303$

Q44 $N = 20 \quad r = 4, \; n = 6$

(a) $P(1) = \frac{{}_4C_1 \cdot {}_{16}C_5}{{}_{20}C_6} = 0.45077$

(b) $P(0) = \frac{{}_4C_0 \cdot {}_{16}C_6}{{}_{20}C_6} = 0.20660$

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(c) $P(x \leq 2) = P(1) + P(0) + P(2)$

$= 0.45077 + 0.20660 + \frac{4C_2 \cdot 16C_4}{20C_6}$

$= 0.93910$

Q45 $P(4) = \frac{11C_4 \cdot 7C_0}{18C_4} = 0.1078$

$P(x \leq 2) = \frac{11C_0 \cdot 7C_4}{18C_4} + \frac{11C_1 + 7C_3}{18C_4} + \frac{11C_2 \cdot 7C_2}{18C_4}$

$= 0.5147$

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

$= 1 - 0.0114 - 0.1258$

$= 0.86280$

Q46 x = keyboard is defective

$P(\text{accept}) = \frac{6C_0 \cdot 14C_5}{20C_5} + \frac{6C_1 \cdot 14C_4}{20C_5}$

$= 0.3875$

$P(\text{reject}) = 1 - (P(0) + P(1))$

$= 1 - 0.3875$

$= 0.6125$

Q49 $P(x \leq 1)$ for $\lambda = 5$

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!} \quad \cdot \quad P(x \leq 1) = P(0) + P(1)$$

$$= \frac{5^0 \cdot e^{-5}}{0!} + \frac{5^1 \cdot e^{-5}}{1!}$$

$$P(x \leq 1) = 0.04043$$

$P(2)$ for $\lambda = 2.5$

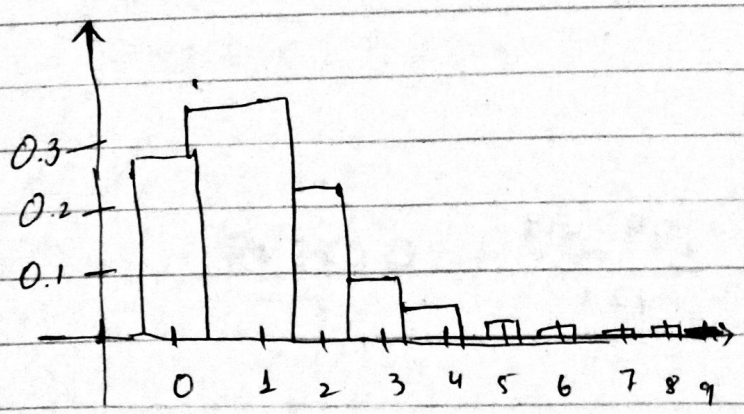
$$P(2) = \frac{2.5^2 \cdot e^{-2.5}}{2!} = 0.25652$$

Q50 (a) $\lambda = 1.3$

x	$P(x)$
0	.2725
1	.3543
2	.2303
3	.0998
4	.0324
5	0.0084
6	0.0018
7	0.0003
8	0.0001
9	0.0000

$\mu = \lambda = 1.3 = \sigma^2$

$\sigma = \sqrt{1.3} = 1.14018$



Q51

$\lambda = 5.4$

$$P(3) = \frac{12.5^3 \cdot e^{-5.4}}{3!} = 0.11853$$

Q52

$\lambda = 12.5$

$$P(3) = \frac{12.5^3 \cdot e^{-12.5}}{3!} = 0.00121$$

Q53

$\lambda = 3.7$

(a) $P(x \leq 1) = P(0) + P(1)$

$$= \frac{3.7^0 \cdot e^{-3.7}}{0!} + \frac{3.7^1 \cdot e^{-3.7}}{1!}$$

$$= 0.1162$$

(b) i) 0.6625
ii) 0.1699
iii) 0.4941

Q54

$$P(3) = \frac{1.6^3 \cdot e^{-1.6}}{3!} = 0.13783$$

b) i) 0.3962
ii) 0.0787
iii) 0.7833

Q55

$$P(12) = \frac{19^{12} \cdot e^{-19}}{12!} = 0.02589$$

(b) i) 0.2314 ii) 0.0015

Q56 (a) $P(0) = \frac{3.2^0 \cdot e^{-3.2}}{0!}$

$= 0.04070$

x	P(x)	x	P(x)	x	P(x)
0	0.0408	5	0.1140	10	0.0003
1	0.1304	6	0.0608	11	0.0004
2	0.2087	7	0.0278	12	0.0001
3	0.2226	8	0.0111	13	0.0000
4	0.1781	9	0.040	14	0.0000

$\lambda = 3.2$

$\sigma = \sqrt{3.2} = 1.78885$

Q57 $P(0) = \frac{0.8^0 \cdot e^{-0.8}}{0!} = 0.4493$

x	P(x)	x	P(x)
0	0.4493	4	0.0077
1	0.3595	5	0.0012
2	0.438	6	0.0002
3	0.0383		

$\mu = 0.8$

$\sigma = \sqrt{0.8} = 0.8944$

Q58 $\lambda = 20, \; x = 25$

$P(25) = \frac{20^{25} \cdot e^{-20}}{25!} = 0.04459$

(b) (i) 0.039 (ii) 0.182 (iii) 0.016

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Q5 (a) $P(25) \quad \frac{20^{25} \cdot e^{-20}}{25!} = 0.04469$

(b) (i) 0.0021 (ii) 0.4542 (iii) 0.0218

(15)