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Homework #1

Q 5.4 Probability distribution of a discrete random variable lists all the possible values that the random variable can assume and their corresponding probabilities. An example could be the probability distribution for TV's owned by households.

Q 5.5 ① $0 \leq P(x) \leq 1$

→ Probability for any 'x' is between 1 and 0 inclusive where 1 ~~is~~ means the event will happen and 0 means the event will not happen

② $\Sigma P(x) = 1$

→ Sum of all probabilities of all values of 'x' will be equal to 1.

Q 5.6 (a) Yes, both conditions ($0 \leq P(x) \leq 1$ and $\Sigma P(x) = 1$) are met

(b) No, $\Sigma P(x) = 0.97 \neq 1$

(c) No, $P(0) = -0.25$ which is not in between 0 and 1

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①

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Q 5.7 (a) $P(3) = 0.15$

(b) $P(x \leq 2) = 0.58$

(c) $P(x \geq 4) = 0.27$

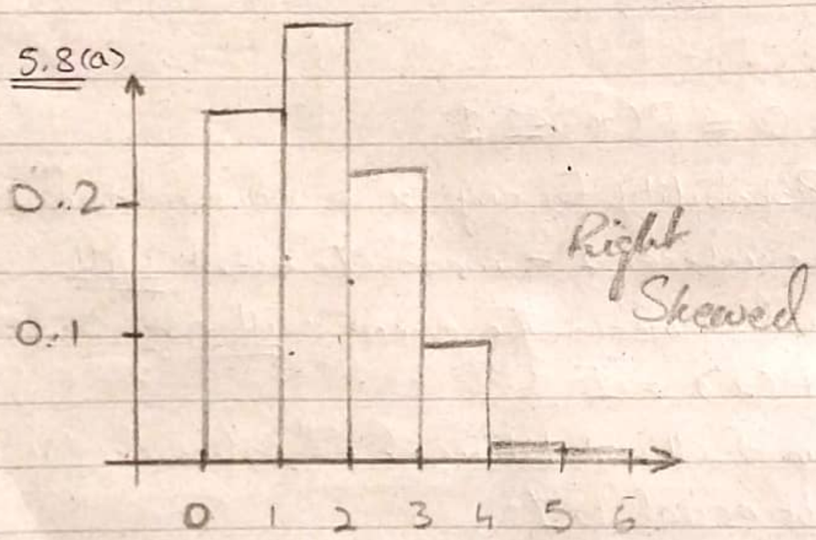
(d) $P(1 \leq x \leq 4) = 0.74$

(e) $P(x < 4) = 0.73$

(f) $P(x > 2) = 0.42$

(g) $P(2 \leq x \leq 5) = 0.64$

Q 5.8 (a)



(b) $P(x \geq 2) = 0.3732$

$P(x = 5) = 0.0084$

$P(x < 3) = 0.8571$

$P(x \leq 1) = 0.6268$

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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)

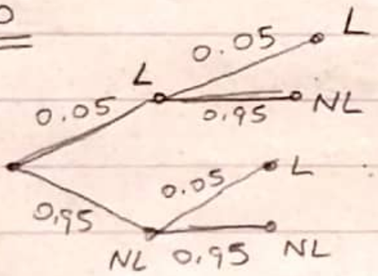
(c) $P(3) = 0.3$

$P(x \geq 3) = 0.65$

$P(2 \leq x \leq 4) = 0.75$

$P(x < 4) = 0.65$

Q 5.10



L = lemon

NL = Not lemon

x	$P(x)$
0	0.9025
1	0.0950
2	0.0025

$$\Sigma P(x) = 0.9025 + 0.0950 + 0.0025 = 1.0000$$

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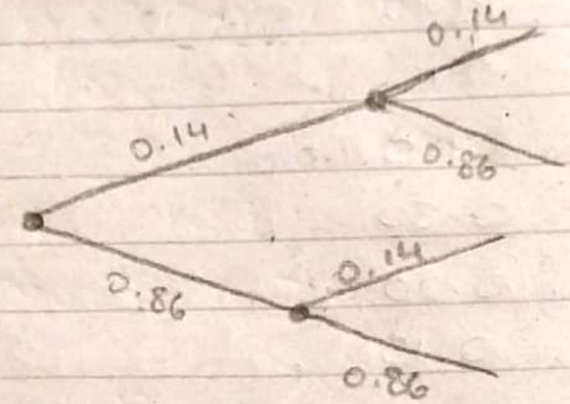
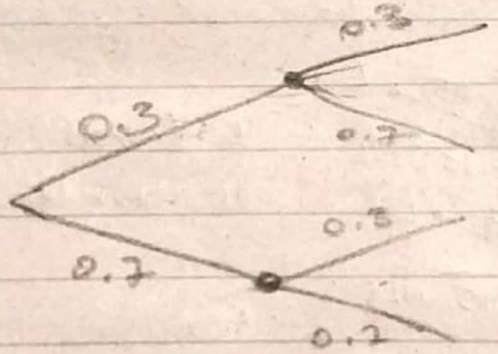
Q 5.11



x	$P(x)$
0	0.7396
1	0.2408
2	0.0196

Q 5.12

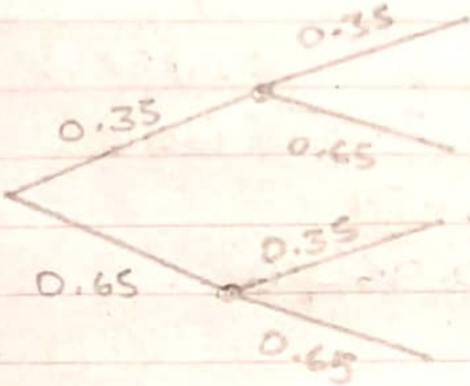


x	$P(x)$
0	0.49
1	0.42
2	0.09

4

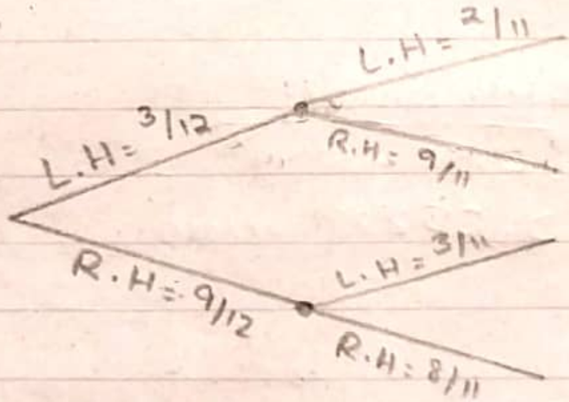
4

Q 5.13



x	$P(x)$
0	0.4225
1	0.4450
2	0.1225

Q 5.14



x	$P(x)$
0	0.5454
1	~~0.0454~~ ~~0.0~~ 0.40920
2	0.0454

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Q 5.16 (a) $\Sigma xP(x) = 1.59$

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

$= 0.96016$

$\therefore$ Mean $= 1.59$

Std Dev $= 0.96016$

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

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

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

$= 1.06071$

Q 5.17 $\Sigma xP(x) = 0.44$

Mean $= 0.44$ errors

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

$= 0.85229$ errors

Q 5.18

$\mu = \Sigma xP(x) = 2.94$ cams sold

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

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

$= 1.44097$ cams sold

Q 5.19 $\mu = \Sigma xP(x) = 1.2997$ patients

$\sigma = \sqrt{\Sigma x^2Px - \mu^2}$

$= 1.13828$ patients

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Q 5.20 $\mu = \sum xP(x) = 2.48$ houses sold

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

$= 1.29985$ houses sold

2.561

Q 5.21 $\mu = \sum xP(x) =$ [redacted] defective tires

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

$= 1.$[redacted] defective tires

1.32245

Q 5.22

~~3/4.3 customers arrive on average in half an hour with a std dev. of 1.61 customers.~~

Q 5.22 $\mu = \sum xP(x) = 3.05$ systems installed

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

$= 1.20312$

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Q 5.23 $\mu = \sum xP(x) = 3.9$ \$ million

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

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Q5.24

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

$$\mu = \sum x P(x)$$

$$= -0.4 \$$$

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

$$= 54.78084 \$$$

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Q 5.25 $\mu = \sum x P(x)$

$= 0.5$

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

$= 0.584$

Q 5.28

(a) No, number of outcomes $\neq 2$ since there are 6 possible outcomes

(b) Yes, it satisfies all 4 conditions of binomial distibution

(c) Yes

Q 5.29

~~(a) No, trials are dependant~~

~~(b) Yes~~

~~(c)~~

(a) Yes

(b) No, trials are dependant

(c) Yes

Q 5.30

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

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

$= 0.25412$

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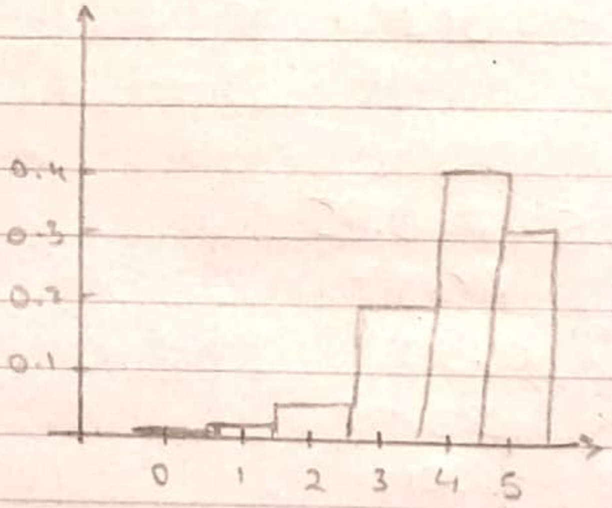
(b) $P(3) = {}_4C_3(.4)^3(.6)^1$
$= 0.1536$

(c) $P(2) = {}_6C_2(.3)^2(.7)^4$
$= 0.32413$

Q 5.31

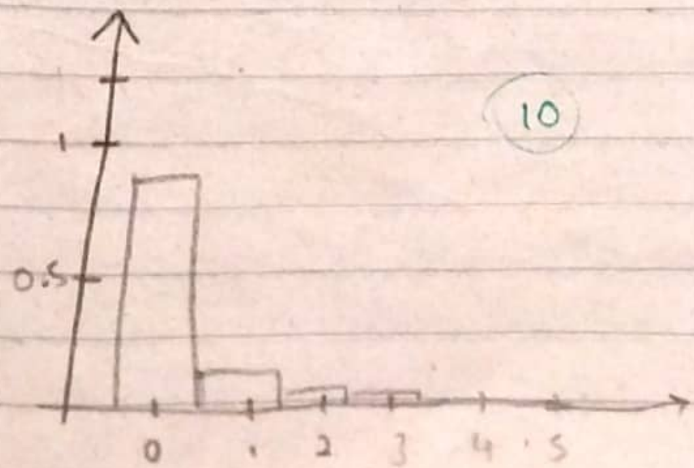
x	$P(x)$
0	0.0003
1	0.0064
2	0.0512
3	0.2048
4	0.4096
5	0.3277



$\mu = np = (5)(0.8) = 4$
$\sigma = \sqrt{npq} = \sqrt{(5)(0.8)(0.2)} = 0.89443$

Q 5.32 for $n = 5$, $P = 0.05$

x	$P(x)$
0	.7738
1	.2036
2	.0214
3	.0011
4	0.000
5	0.000



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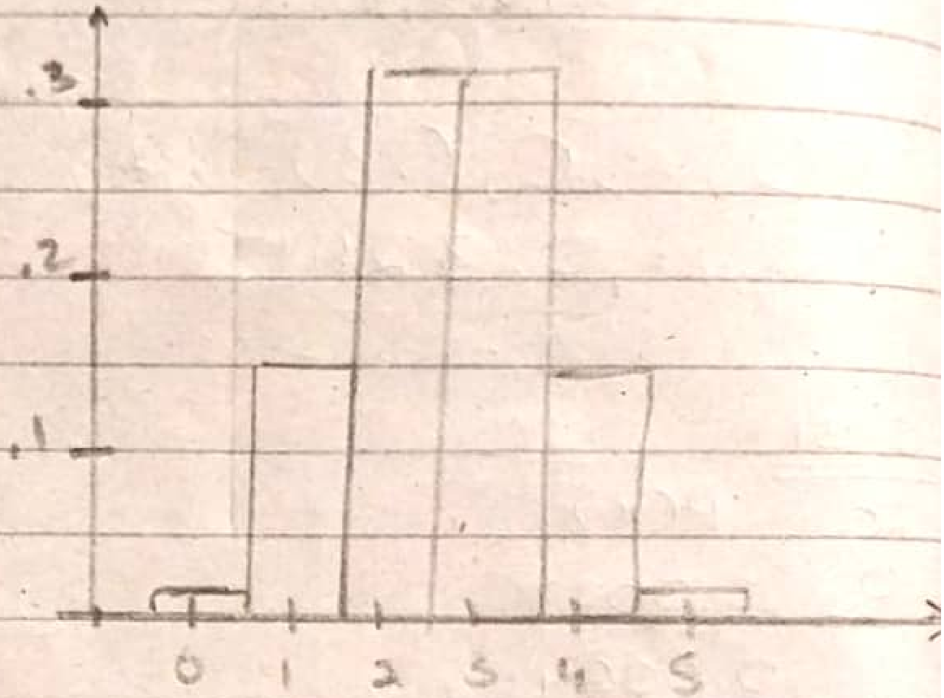
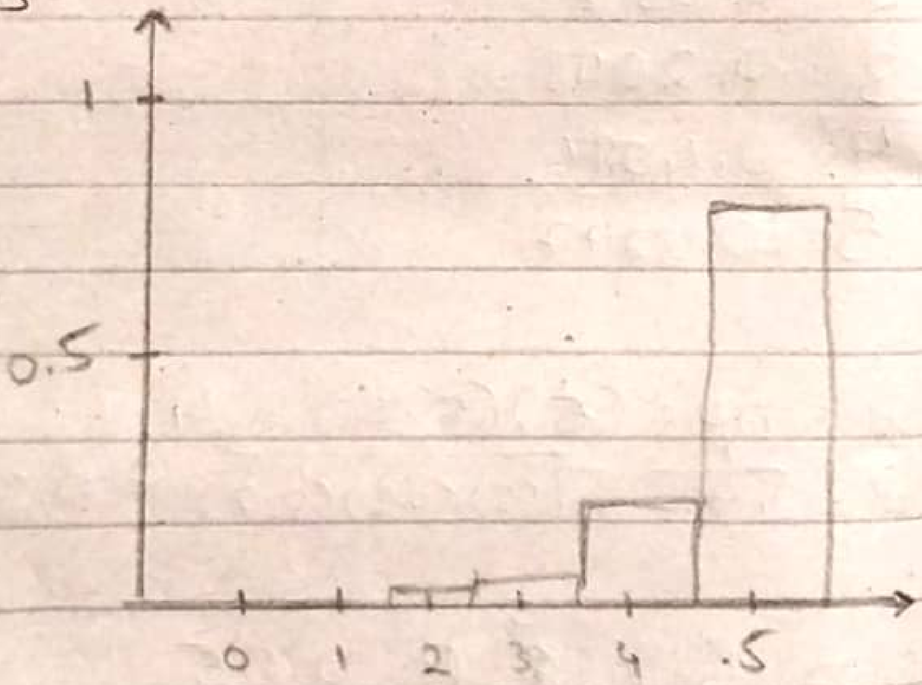
$n = 5, P = 0.5$

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



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Q 5.33

(a) All values from 0 - 10

(b) $P(x) = {}_nC_x \, P^x q^{n-x}$

$P(6) = {}_{10}C_6 \, (.7)^6 (.3)^4$

$= 0.2001$

Q 5.34

(a) Any value from 0 - 12

(b) ${}_{12}C_3 \, (0.18)^3 (0.82)^9$

$= 0.215$

Q 5.35 (a) $P(x \geq 4) = 0.7031$

(b) $P(1 \leq x \leq 3) = 0.2921$

(c) $P(x \leq 5) = 0.7215$

Q 5.36 (a) $P(x \leq 5) = \cancel{29.05\%}$ 0.2905

(b) $P(6 \leq x \leq 9) = 0.6634$

(c) $P(x \geq 7) = 0.5$

Q 5.37 $n = 4$, $P = 0.88$, $q = 0.12$

(a) $P(4) = {}_4C_4 \, (0.88)^4 (0.12)^0$

$= 0.5997$ probability he converts all 4

(b) $P(0) = {}_4C_0 \, (0.88)^0 (0.12)^4$

$= 0.00021$

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Q 5.38 (a) $P(8) = {}_8C_8 (0.85)^8 (0.15)^0$

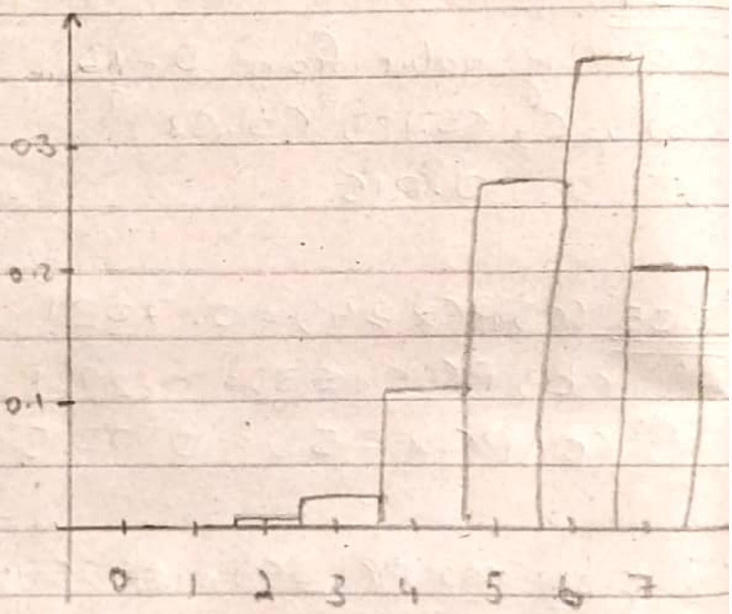
$= 0.27249$

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

$= 0.08386$

Q 5.39

x	$P(x)$
0	0.0000
1	0.0004
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

$P(4) = 0.1147$

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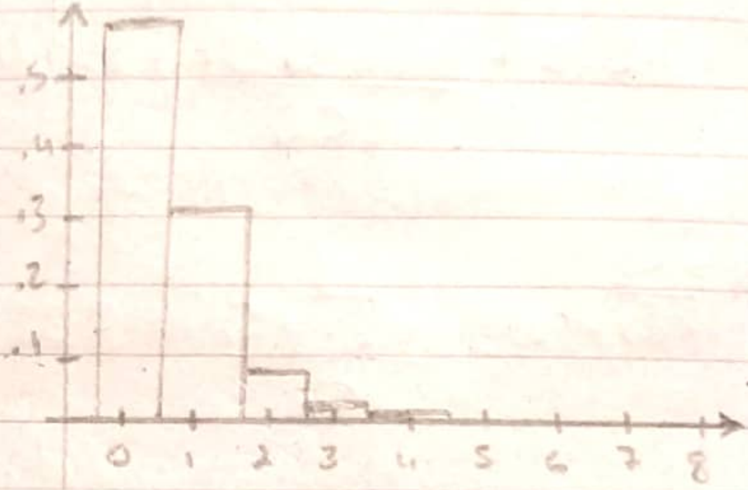
Q 5.40

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

Q 5.42 $P(x) = \dfrac{{}_rC_x \cdot {}_{N-r}C_{n-x}}{{}_NC_n}$

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

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

(c) $P(x \leq 1)$

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

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

Q 5.43

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

(b) $P(4) = \frac{{}_4C_4 \cdot {}_7C_0}{{}_{11}C_4} = 0.0030$

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

$= 0.5303$

Q 5.44 $N = 20, r = 4, n = 6$

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

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

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

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$$P(x \le 2) = 0.45077 + 0.20660 + \frac{{}_4C_2 \cdot {}_{16}C_4}{{}_{20}C_6}$$

$$= 0.93910$$

Q 5.45

$$P(4) = \frac{{}_{11}C_4 \cdot {}_7C_0}{{}_{18}C_4} = 0.1078$$

$$P(x \le 2) = \frac{{}_{11}C_0 \cdot {}_7C_4}{{}_{18}C_4} + \frac{{}_{11}C_1 \cdot {}_7C_3}{{}_{18}C_4} + \frac{{}_{11}C_2 \cdot {}_7C_2}{{}_{18}C_4}$$

$$= 0.5147$$

$$P(x > 1) = 1 - P(0) - P(1)$$
$$= 1 - 0.0114 - 0.1258$$ (taken from part b)
$$= 0.86280$$

Q 5.46 x = keyboard is defective

$N = 20$
$r = 6$
$n = 5$
5 out of 20
6 out of 20

$$P(\text{accept}) = \frac{{}_6C_0 \cdot {}_{14}C_5}{{}_{20}C_5} + \frac{{}_6C_1 \cdot {}_{14}C_4}{{}_{20}C_5}$$

= 0.3875 is the probability of the shipment being accepted

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

$= 1 - (0.3875)$

$= 0.6125$

Q 5.49 $P(x \leq 1)$ for $\lambda = 5$

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

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

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

$= 0.00674 + 0.03369$

$= 0.04043$

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

$$= \frac{2.5^2 \cdot e^{-2.5}}{2!}$$

$= 0.25652$

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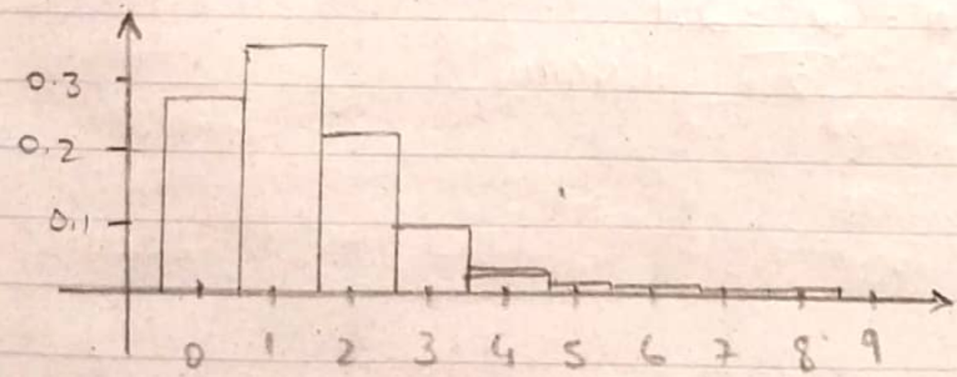
Q 5.50 (a) $\lambda = 1.3$

$\lambda = 1.3$

x	$P(x)$	x	$P(x)$
0	.2725	5	.0084
1	.3543	6	.0018
2	.2303	7	.0003
3	.0998	8	.0001
4	.0324	9	.0000

$\mu = \lambda = 1.3 = \sigma^2$ (mean = Variance = λ)

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



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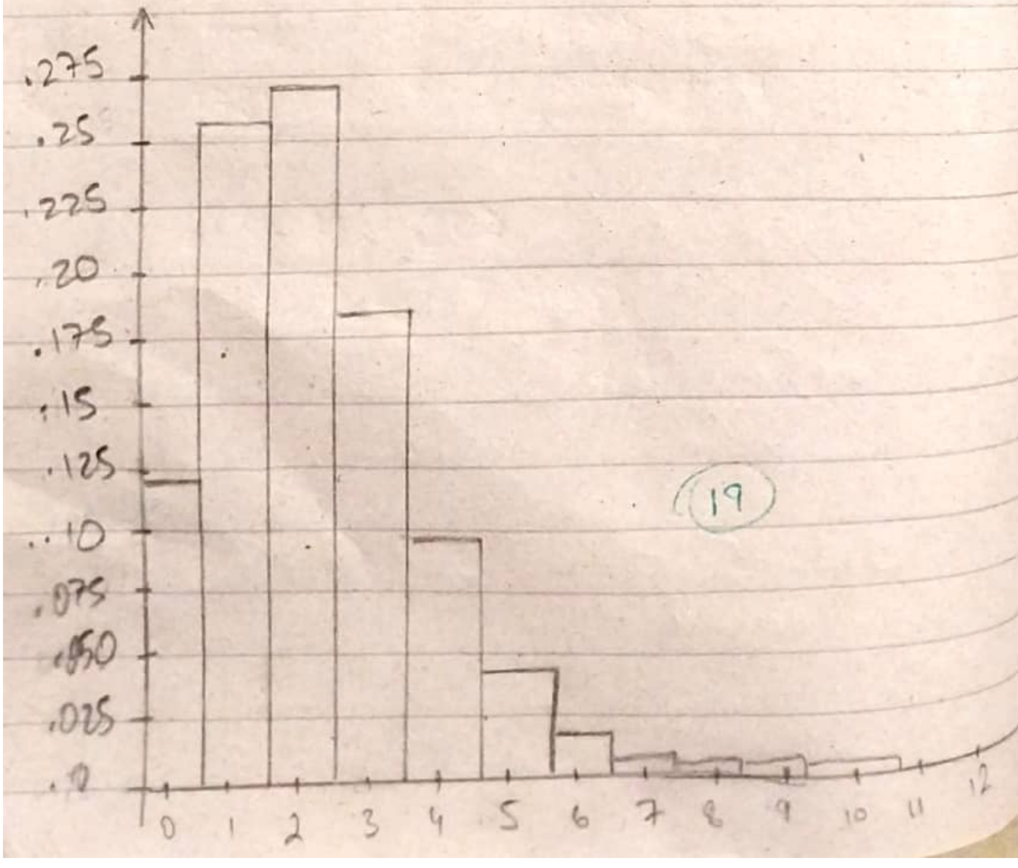
Q 5.50

(b) $\lambda = 2.1$

x	$P(x)$	x	$P(x)$
0	.1225	5	.0146
1	.2572	7	.0044
2	.2700	8	.0011
3	.1890	9	.0003
4	.0992	10	.0001
5	.0417	11	.0000
		12	.0000

$\lambda = \mu = \sigma^2 = 2.1$

$\sigma = \sqrt{2.1} = 1.44914$



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Q 5.51

$\lambda = 5.4$

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

Q 5.52 $\lambda = 12.5$

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

Q 5.53 $\lambda = 3.7$

(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

Q 5.54

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

(b) (i) 0.3962

(ii) 0.0787

(iii) 0.7833

Q 5.55

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

(b) (i) 0.2314 (ii) 0.0015

Q 5.56

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

$$= 0.04076$$

x	$P(x)$	x	$P(x)$	x	$P(x)$
0	.0408	5	.1140	10	.0013
1	.1304	6	.0608	11	.0004
2	.2087	7	.0278	12	.0001
3	.2226	8	.0111	13	.0000
4	.1781	9	.0040	14	.0000

$$\lambda = \sigma^2 = \mu = 3.2$$

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

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Q 5.57 $P(0) = \frac{0.8^0 \cdot e^{-0.8}}{0!} = 0.4493$

x	$P(x)$	x	$P(x)$
0	0.4493	4	0.0077
1	0.3595	5	0.0012
2	0.1438	6	0.0002
3	0.0383		

$\mu = \lambda = \sigma^2 = 0.8$

$\sigma = \sqrt{0.8} = 0.894$

Q 5.58

$\lambda = 20, x = 25$

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

(b) i) 0.039 (ii) 0.182 (iii) 0.0218

Q 5.59

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

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