INU-Ph 2	Biostat final exam	22 june 2020
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Question(1) a) calculate the correlation coefficient between X and Y.

Price X	3	4	5	6	7	8	9	10	11	13
Demand Y	25	24	20	20	19	17	16	13	10	8

Let $u = X - 7$

and $v = Y - 19$

Then $r_{xy} = r_{uv}$:

X	Y	u	v	u^2	v^2	uv
3	25	-4	6	16	36	-24
4	24	-3	5	9	25	-15
5	20	-2	1	4	1	-2
6	20	-1	1	1	1	-1
7	19	0	0	0	0	0
8	17	1	-2	1	4	-2
9	16	2	-3	4	9	-6
10	13	3	-6	9	36	-18
11	10	4	-9	16	81	-36
13	8	6	-11	36	121	-66
Σ 76	Σ 172	Σ 6	Σ -18	Σ 96	Σ 314	Σ -170

now

$$r = \frac{\Sigma uv - (\Sigma u)(\Sigma v)/n}{\sqrt{\left(\Sigma u^2 - \frac{(\Sigma u)^2}{n}\right)\left(\Sigma v^2 - \frac{(\Sigma v)^2}{n}\right)}}$$

$$= -170 - (6)(-18)/10 = -170 - (-108)/10$$

4

Question 1 (a) $= -170 - 10.8$
contd...
$= -159.2$

$$= \sqrt{96 - (6)^2/10}$$

$$= 96 - 36/10 = 96 - 3.6 = \sqrt{92.4}$$

$$= \sqrt{314 - (-18)^2/10}$$

$$= 314 - (-324)/10 = 314 - 32.4$$

$$= \sqrt{281.6}$$

$$= \sqrt{92.4 - 281.6}$$

$$= 161.306$$

$$= \frac{159.2}{161.3}$$

$$= 0.9869$$

so X and Y = 0.9869 or 0.98

b) Given the following values (set of)

X	20	11	15	10	17	18	21	25	28
Y	5	15	14	17	8	9	12	16	18

a) Determine the equation of the latest square regression line of Y on X & X on Y

The estimate linear regression line X on Y is as follows:

$$\hat{Y} = a + bx.$$

where a and b are least square

(2)

Question (1) b) estimate of the parameter α and β
conti... respectively and are given by.

X	Y	X^2	Y^2	XY
20	5	400	25	100
11	15	121	225	165
15	14	225	196	210
10	17	100	239	170
17	8	289	64	136
18	9	324	81	162
21	12	441	144	252
25	16	625	256	400
28	18	784	324	504
$\Sigma 165$	$\Sigma 114$	$\Sigma 3309$	$\Sigma 1604$	$\Sigma 2099$

$$b = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{n\Sigma X^2 - (\Sigma X)^2}$$

$a = \bar{Y} - b\bar{X}$

substituting the sum we get

$$b = \frac{(9)(2099) - (165)(114)}{(9)(3309) - (165)^2}$$

$$b = \frac{18891 - 18810}{29781 - 27225}$$

$$\therefore b = \frac{81}{2556} = \frac{9}{287}$$

$$b = 0.031$$

So $a = \bar{y} - 0.031\bar{x}$

finding a

$$a = 114/9 - (0.031)(16/9)$$

$$a = 12.66 - (0.031)(18.33)$$

Question (1) b)
Conti...

$a = 12.66 - 0.568$

$a = 12.09$

Hence: $X = a + bY$

$$b = \frac{(9)(2099) - (165)(114)}{(9)(1604) - (114)^2}$$

$$b = \frac{18891 - 18810}{14436 - 12996}$$

$b = 81/1440$

$b = 0.056$

Now

$a = \bar{X} - b\bar{Y}$ (X on Y)

$$a = \frac{165}{9} - (0.056)(114/9)$$

$a = 18.33 - 0.709$

$a = 17.62$

Hence: $X = a + bY$

$X = 17.62 + 0.056Y$

b) Find the predicted value of Y for X = 20, 11, 15, 25, 28...

X	Y	$Y = 12.09 + 0.031x$	$X = 17.62 + 0.056Y$
20	5	$= 12.09 + (0.031)(20) = 12.71$	$17.62 + 0.056(5) = 17.88$
11	15	12.431	18.37
15	14	12.555	18.40
10	17	12.4	18.57
17	8	12.617	18.06
18	9	12.648	18.12
21	12	12.741	18.29
25	16	12.865	18.51
28	18	12.958	18.62

$Y = 12.09 + 0.031X$ & $X = 17.62 + 0.056Y$ were obtained from previous part.

Question (02). find the following:

a) A fair coin is tossed 5 times. find the probabilities of obtaining various number of heads.

Let us regard the tossing of a coin as an experiment

We then observe the following:

i) each of a tossed coin has two possible out comes head or a tail

ii) the probability of a head is $p = \frac{1}{2}$ and remain the same for successive tosses

iii) the successive tosses of coin are independent

iv) the coin is tossed 5 times.

Therefore X which denots the number of heads has a binomial probability distribution with $p = 1/2$ and $n = 5$

Therefore possible value of X are 1, 2, 3, 4 & 5

$\rightarrow P(\text{no head}) = P(X=0) = \binom{5}{0}\left(\frac{1}{2}\right)^0\left(\frac{1}{2}\right)^5$

$= 1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$

$\rightarrow P(1\text{ head}) = P(X=1) = \binom{5}{1}\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{5-1} =$

$5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$

$\rightarrow P(2\text{ heads}) = P(X=2)\ \binom{5}{2}\left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^{5-2}$

$10 \times \left(\frac{1}{2}\right)^5 = \frac{10}{32}$

$\rightarrow P(3\text{ head}) = P(X=3)\ \binom{5}{3}\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3}$

$10 \times \left(\frac{1}{2}\right)^5 = 10/23$

Question 2 (a) → $P(4\text{heads}) = P(X=4) = \binom{5}{4}\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^{5-4}$
conti...

$5 \times \left(\frac{1}{2}\right)^5 = \frac{5}{32}$

→ $P(5\text{head}) = P(X=5)\ \binom{5}{5}\left(\frac{1}{2}\right)^5\left(\frac{1}{2}\right)^0$

$1 \times \left(\frac{1}{2}\right)^5 = \frac{1}{32}$.

These probabilities can also be obtained by expanding the binomial $\left(\frac{1}{2}+\frac{1}{2}\right)^5$
The binomial for distribution for the number of heads is 5 tosses of a fair coin.

x.	0	1	2	3	4	5
	$\frac{1}{32}$	$\frac{5}{32}$	$\frac{10}{32}$	$\frac{10}{32}$	$\frac{5}{32}$	$\frac{1}{32}$

b) Data given

Therefore we in this question need to find

i) win of atleast 4 games.

with the data given

$n = 10$

$p = 2/3$

$q = 1-p$

$q = 1 - 2/3$

$q = 1/3$

X denote the number of won of A

thus we find the wins that are:

Question 2 b) $P(x \geq 4) = 1 - P(X < 4)$

conti...

$1 - \sum^{3}$

$$1 - \sum_{x=0}^{3} \binom{10}{x} \left(\frac{2}{x}\right)^{x=0} \left(\frac{1}{3}\right)^{9} + 45 \left(\frac{2}{3}\right)^{2} \left(\frac{1}{3}\right)^{8}$$

$$+ 120 \left(\frac{2}{3}\right)^{3} \left(\frac{1}{3}\right)^{7}$$

$$= 1 - \frac{1}{59049} \left[1 + 20 + 80 + 960\right)$$

$$1 - 0.0197$$

$$P(x \geq 4) = 0.9803$$

iii) Exactly equal to 11 games:

$P(x=11) = f(0)$ = because X can only take value of $0, 1, 2, 3 \ldots 10$

thus we can't predict when only 10 games are played

ii) Exactly equal to 4/10 games:

$$P(x=4) = \binom{10}{4} \left(\frac{2}{3}\right)^{4} \left(\frac{1}{3}\right)^{6}$$

$$= 210 \left(\frac{16}{81}\right)$$

$$= \frac{1}{729}$$

$$= \frac{3360}{59049}$$

Question 2b : thus
contd...

$$P(x=4) = 0.056$$

iv) 6 or more games.

$$P(x \geq 6)$$

$$P(x \geq 6) = \sum_{x=60}^{10} \binom{10}{x} \left(\frac{2}{3}\right)^{x} \left(\frac{1}{3}\right)^{10-x}$$

$$\binom{10}{6}\left(\frac{2}{3}\right)^{6}\left(\frac{1}{3}\right)^{4} + \binom{10}{7}\left(\frac{2}{3}\right)^{9}\left(\frac{1}{3}\right)^{3}$$

$$+ \binom{10}{10}\left(\frac{2}{3}\right)^{10}\left(\frac{1}{3}\right)^{0}$$

$$= 0.228 + 0.261$$
$$+ 0.196$$
$$+ 0.087 + 0.018$$

$$P(x \geq 6) = 0.79$$

Thuse we can citeupat or find out the probability of the number of times A wins with the probability of $2/3$ in a total of 10 games

Question (03) The following figure give the number of children born to 50 women.

2	6	1	5	4	3	3	8	10	1
4	3	3	0	5	2	1	4	10	3
5	3	3	6	3	3	2	2	7	4
1	4	2	4	4	4	6	8	10	7
7	5	6	5	3	2	3	9	2	2

a) Construct the ungrouped frequency distribution of these data:

Ungrouped:

no. of child.	no. of woman	(C.F)	Tally
0	1	1	I
1	4	5	IIII
2	8	13	~~IIII~~ III
3	11	24	~~IIII~~ ~~IIII~~ I
4	8	32	~~IIII~~ III
5	5	37	~~IIII~~
6	4	41	IIII
7	3	44	III
8	2	46	II
9	1	47	I
10	3	50	III
	Σ50	Σ340	

no. of children give in the data
no. of women was also presented in the data
C.F is the addition of frequency like in zig zag motion.

Question 3 b) Construct the frequency (grouped distribution of these data:
Conti...

1) In group we find out frequency
2) Compulated frequency
3) class boundries
4) class mark

Finding of class interval using the given data
where $n = 50$
X maximum: 10
X minimum: 0
$10 - 0 = 10$
max − min = 10
divide ÷ 5
$10/5 = 2$
→ thus class interval = 2
→ Class Boundry : $1/2 = 0.5$
−0.5 first class
+0.5 second class
→ Mid point or mid value is found there mid point method.
The Below table shows the following:-

Classes	Enlaiss	frequency	C. freq.	C.B	Mid
0−2	0, 1(4), 2(7)	13	13	0.5−2.5	1
3−5	3(12), 4(4), 5(5)	24	37	2.5−5.5	4
6−8	7(3), 8(2)	9	46	5.5−8.5	7
9−11	9, 10(3)	4	50	8.5−11.5	10
		Σ 50			