

M Tech(Data Science & Engineering)
Introduction to Statistical Methods [ISM]

BITS Pilani

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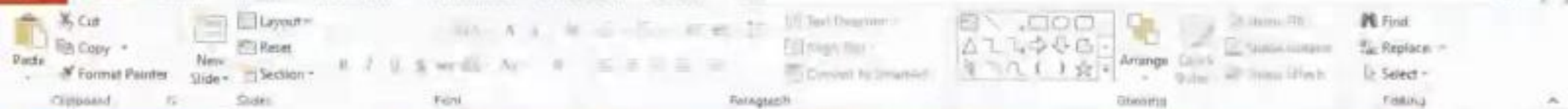
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M Tech(Data Science & Engineering) Introduction to Statistical Methods [ISM]



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Webinar Session No- 4
22nd Feb-2022
Timings : 7.30 to 9.00 PM

Learning objectives

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- Testing of Hypothesis
- Correlation and Regression

Procedure of **Testing of Hypothesis**

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Step-1: setup Null hypothesis H_0

Step-2: setup Alternate hypothesis H_1

Step-3: Choose appropriate Level of significance (LOS)

Step-4: Test Statistic

Step-5: Decision

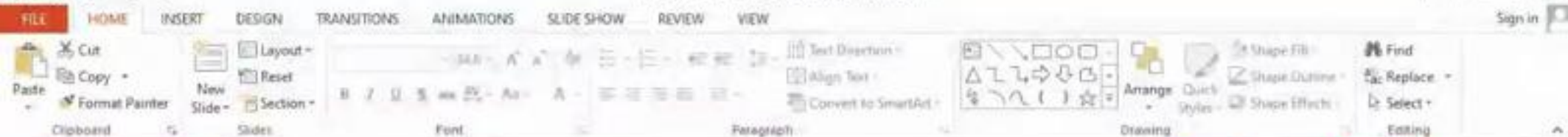


Problem 1

In order to determine whether 'perfection' in job depends on the 'experience'. 400 persons were examined yielding the following data

	Experience			
perfection		high	medium	low
	Excellent	23	60	29
	Good	28	79	60
	Satisfactory	9	49	63

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Procedure of Testing of Hypothesis

Step-1: setup Null hypothesis H_0

Step-2: setup Alternate hypothesis H_1

Step-3: Choose appropriate Level of significance (LOS)

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Step-5: Decision

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Procedure of **Testing of Hypothesis**

Step-1: setup Null hypothesis H_0

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Problem 1

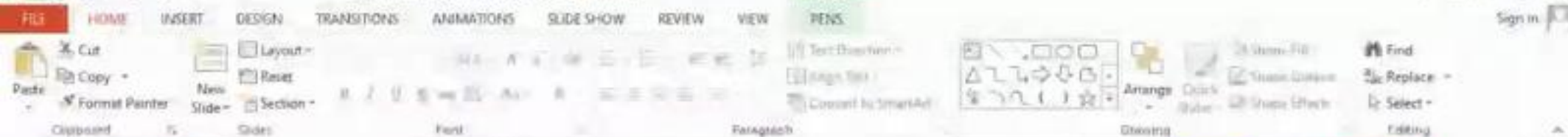
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		high	medium	low
	perfection	23	60	29
	Excellent	28	79	60
	Good	9	49	63
	Satisfactory			

Solution-1

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H_0 : The perfection in job depends on experience

H_1 : The perfection in job not depends on experience

The observed frequencies are

	Experience				Total
		high	medium	low	
perfection	Excellent	$O_{11} = 23$	$O_{12} = 60$	$O_{13} = 29$	112
	Good	$O_{21} = 28$	$O_{22} = 79$	$O_{23} = 60$	167
	Satisfactory	$O_{31} = 9$	$O_{32} = 49$	$O_{33} = 63$	121
	Total	60	188	152	400

Problem 1

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	Experience			
perfection		high	medium	low
	Excellent	23	60	29
	Good	28	79	60
	Satisfactory	9	49	63

$$\alpha = 5\%$$
$$\alpha = 0.05$$

Solution-1

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	Experience				Total
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	Total	60	188	152	400

Solution-1

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Expected frequencies are:

E_{11}	$\frac{(60 \times 112)}{400} = 16.8$
E_{12}	$\frac{(188 \times 112)}{400} = 52.6$
E_{13}	$\frac{(152 \times 112)}{400} = 42.6$
E_{21}	$\frac{(60 \times 167)}{400} = 25$
E_{22}	$\frac{(188 \times 167)}{400} = 78.5$
E_{23}	$\frac{(152 \times 167)}{400} = 63.5$
E_{31}	$\frac{(60 \times 121)}{400} = 18.2$
E_{32}	$\frac{(188 \times 121)}{400} = 56.9$
E_{33}	$\frac{(152 \times 121)}{400} = 45.9$

Solution-1

H_0 : The perfection in job depends on experience

H_1 : The perfection in job not depends on experience

The observed frequencies are

	Experience				Total
		high	medium	low	
perfection	Excellent	$O_{11} = 23$ $E_{11} = \frac{60 \times 112}{400}$	$O_{12} = 60$	$O_{13} = 29$	112
	Good	$O_{21} = 28$	$O_{22} = 79$	$O_{23} = 60$	167
	Satisfactory	$O_{31} = 9$	$O_{32} = 49$	$O_{33} = 63$	121
	Total	60	188	152	400

O_{ij}

E_{ij}



Solution-1

The Chi-square value is

O's	E's	(O-E)	(O-E) ²	$\frac{(O-E)^2}{E}$
25	16.8	8.2	67.24	4.15
60	52.6	7.4	54.76	1.04
29	42.6	-13.6	184.96	4.34
28	25	3	9	0.36
79	78.5	0.5	0.25	0.003
60	63.5	-3.5	12.25	0.19
9	18.2	9.2	84.64	4.65
49	56.9	-7.9	62.41	1.1
63	45.9	17.1	292.41	6.37
Total				22.20

$$\frac{(O_1 - E_1)^2}{E_1}$$

$$\frac{67.24}{16.8}$$

Solution-1

The Chi-square value is

O's	E's	(O-E)	$(O - E)^2$	$\frac{(O - E)^2}{E}$
25	16.8	8.2	67.24	4.15
60	52.6	7.4	54.76	1.04
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9	18.2	-9.2	84.64	4.65
49	56.9	-7.9	62.41	1.1
63	45.9	17.1	292.41	6.37
			Total	22.20

$$\frac{(O_{11} - E_{11})^2}{E_{11}}$$

$$\frac{67.24}{16.8}$$

χ^2 - Critical Values of the Chi-squared Distribution with ν Degrees of Freedom

ν	0.10	0.25	0.50	0.10	0.05	0.025	0.01	0.005	0.001
1	1.674	1.321	1.062	2.706	3.841	5.024	7.879	10.828	16.267
2	2.009	1.578	1.385	3.841	5.024	5.991	9.210	12.592	18.475
3	2.366	1.848	1.600	4.605	5.841	6.938	10.243	13.838	20.090
4	2.706	2.108	1.753	5.405	6.635	7.779	11.142	14.860	21.999
5	3.000	2.366	1.903	6.251	7.413	8.538	12.090	15.890	23.888
6	3.253	2.592	2.048	7.053	8.153	9.236	12.938	16.812	25.719
7	3.501	2.800	2.188	7.879	8.953	9.933	13.788	17.729	27.488
8	3.745	2.996	2.319	8.671	9.718	10.645	14.602	18.635	29.154
9	3.979	3.178	2.446	9.488	10.457	11.344	15.409	19.542	30.764
10	4.168	3.341	2.567	10.297	11.158	12.033	16.191	20.483	32.179
11	4.328	3.490	2.683	11.070	11.813	12.691	16.919	21.454	33.572
12	4.478	3.621	2.790	11.813	12.401	13.277	17.591	22.364	34.901
13	4.605	3.745	2.891	12.592	12.938	13.838	18.209	23.216	36.191
14	4.719	3.858	2.987	13.338	13.442	14.361	18.759	23.984	37.429
15	4.818	3.958	3.078	14.067	13.938	14.860	19.245	24.696	38.582
16	4.903	4.049	3.165	14.779	14.443	15.338	19.699	25.363	39.652
17	4.974	4.131	3.248	15.478	14.933	15.791	20.137	26.004	40.646
18	5.033	4.205	3.327	16.159	15.408	16.225	20.569	26.618	41.565
19	5.081	4.272	3.403	16.812	15.872	16.641	20.984	27.204	42.418
20	5.129	4.331	3.476	17.459	16.328	17.033	21.391	27.769	43.191
21	5.174	4.383	3.547	18.099	16.779	17.401	21.791	28.316	43.891
22	5.217	4.437	3.616	18.723	17.224	17.750	22.191	28.845	44.561
23	5.259	4.483	3.683	19.343	17.658	18.086	22.591	29.358	45.201
24	5.299	4.530	3.748	19.951	18.073	18.411	22.989	29.853	45.821
25	5.337	4.578	3.811	20.540	18.475	18.728	23.379	30.334	46.421
26	5.374	4.627	3.872	21.129	18.868	19.037	23.760	30.800	46.991
27	5.409	4.677	3.931	21.709	19.253	19.338	24.142	31.254	47.541
28	5.443	4.728	3.989	22.281	19.628	19.631	24.518	31.696	48.071
29	5.476	4.779	4.046	22.845	19.995	19.917	24.891	32.129	48.581
30	5.508	4.831	4.101	23.401	20.351	20.199	25.269	32.552	49.081
31	5.539	4.883	4.155	23.949	20.697	20.473	25.642	32.966	49.571
32	5.569	4.937	4.208	24.490	21.034	20.741	26.011	33.371	50.051
33	5.598	4.991	4.261	25.023	21.361	21.003	26.376	33.768	50.521
34	5.627	5.046	4.313	25.549	21.679	21.259	26.738	34.158	50.981
35	5.655	5.099	4.365	26.069	21.990	21.511	27.097	34.541	51.431
36	5.683	5.153	4.416	26.581	22.295	21.759	27.453	34.918	51.871
37	5.710	5.208	4.467	27.087	22.594	22.003	27.806	35.291	52.301
38	5.737	5.263	4.517	27.587	22.887	22.243	28.157	35.658	52.721
39	5.763	5.318	4.567	28.081	23.174	22.479	28.506	36.021	53.131
40	5.789	5.373	4.617	28.579	23.457	22.711	28.853	36.379	53.531

Solution- 1

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The Chi-square value is $\chi^2 = \sum_1^9 \frac{(O-E)^2}{E} = \underline{22.20} = \chi^2_{cal}$

$$\alpha = 0.05 = 5\%$$

$$(m-1)(n-1) =$$

dof is $(3-1)(3-1) = \underline{4}$ and Level of significance $\alpha = 0.05$

χ^2 tab value is 9.488

χ^2 calculated = 22.20 > χ^2 tab = 9.488 at $\alpha = 0.05$ for 4 dof

Decision : we reject the Null hypothesis H_0 at $\alpha = 5\%$ LOS.

i.e, we accept H_1 .

χ^2 - Critical Values of the Chi-squared Distribution with ν Degrees of Freedom

α	0.10	0.25	0.50	0.10	0.05	0.025	0.01	0.005	0.001
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6	3.254	2.538	2.009	5.989	12.592	14.449	18.548	19.833	28.558
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10	4.168	3.153	2.538	7.337	18.307	20.483	25.188	26.754	37.566
11	4.348	3.291	2.664	7.633	19.675	21.920	26.754	28.307	39.930
12	4.521	3.421	2.789	7.919	21.026	23.337	28.307	29.919	42.313
13	4.685	3.547	2.911	8.191	22.362	24.736	29.919	31.526	44.668
14	4.848	3.670	3.031	8.445	23.685	26.119	31.526	33.151	47.001
15	5.001	3.790	3.149	8.691	25.000	27.488	33.151	34.797	49.332
16	5.153	3.908	3.264	8.929	26.296	28.845	34.797	36.449	51.667
17	5.299	4.023	3.377	9.152	27.587	30.191	36.449	38.155	54.000
18	5.443	4.135	3.488	9.362	28.869	31.526	38.155	39.851	56.332
19	5.586	4.245	3.597	9.551	30.143	32.852	39.851	41.582	58.620
20	5.729	4.353	3.704	9.732	31.410	34.170	41.582	43.297	60.871
21	5.871	4.458	3.809	9.904	32.671	35.479	43.297	44.985	63.167
22	5.991	4.561	3.912	10.067	33.924	36.781	44.985	46.656	65.401
23	6.110	4.661	4.013	10.223	35.178	38.076	46.656	48.289	67.658
24	6.228	4.759	4.112	10.371	36.421	39.364	48.289	49.895	69.880
25	6.345	4.855	4.209	10.511	37.652	40.646	49.895	51.456	72.072
26	6.461	4.949	4.304	10.644	38.885	41.923	51.456	53.000	74.225
27	6.576	5.041	4.397	10.771	40.113	43.195	53.000	54.539	76.344
28	6.690	5.131	4.488	10.891	41.337	44.461	54.539	56.074	78.420
29	6.803	5.219	4.577	11.004	42.557	45.722	56.074	57.598	80.460
30	6.915	5.305	4.664	11.111	43.772	46.979	57.598	59.102	82.483

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Solution-1

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The Chi-square value is

O's	E's	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
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63	45.9	17.1	292.41	6.37
			Total	22.20

$$\frac{(O_i - E_i)^2}{E_i}$$

$$\frac{67.24}{16.8}$$

$$= \sum \frac{(O_i - E_i)^2}{E_i}$$

Solution- 1

The Chi-square value is $\chi^2 = \sum_1^9 \frac{(O-E)^2}{E} = 22.20 = \chi^2_{cal}$ $\alpha = 0.05 = 5\%$

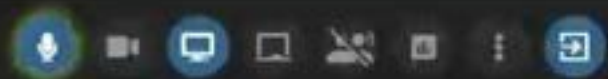
$(m-1)(n-1) =$
dof is $(3-1)(3-1) = 4$ and Level of significance $\alpha = 0.05$

χ^2 tab value is 9.488

χ^2 calculated = 22.20 > χ^2 tab = 9.488 at $\alpha = 0.05$ for 4 dof

Decision : we reject the Null hypothesis H_0 at $\alpha = 5\%$ LOS.

i.e, we accept H_1 .



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not attributed?

DEETA RAMANI BALA PRASADA joined

DEEPAK KUMAR KAMRA joined

SOURAV RAJ joined

HARSH VASHIST joined

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DEEPAK KUMAR KAMRA joined

AASANKHA JAIN joined

Sandra G V

Sandra Vedula

Mathur

Sandra Vedula

possible sir

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Solution-1

The Chi-square value is $\chi^2 = \sum \frac{(O-E)^2}{E} = 22.20 = \chi^2_{cal}$ $\alpha = 0.05 = 5\%$

$dof = (3-1)(3-1) = 4$ and Level of significance $\alpha = 0.05$

χ^2_{tab} value is 9.488

$\chi^2_{calculated} = 22.20 > \chi^2_{tab} = 9.488$ at $\alpha = 0.05$ for 4 dof

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i.e. we accept H_1

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Solution- 1

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Chat

Participants (27)

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DEEPAK KUMAR KANHA joined

SOURAV RAJ joined

NARSIMHASWAMY joined

Isn't the first 0 230?

DEEPAK K K joined

AASANKHA JAIN joined

Raghavendra G V
3.08

4

Ravi Chandra Vedula
4.002

Mukul Mathur
4

Ravi Chandra Vedula
Not visible sir

SAGI S joined

Mukul Mathur
screen is visible to me

Raghavendra G V
yes sir

Learning HubSpot
Welcome everyone

>

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Problem 2

Suppose that Government of India wants to implement a new education policy. They have taken the opinion from the premier institutions before taking decision. Following are the details. Based on this can we conclude that all are having same opinion on the policy.

Institute	Supported	Against	Neutral
IITs	50	50	30
NITs	40	70	40
IITS	30	80	10

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Chat Participants (27)

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AAKASHA JAIN joined

Raghavendra G V
3.98

4

Ravi Chandra Vedula
4.002

Mukul Mishra
4

Ravi Chandra Vedula
Not visible sir

SAGI S joined

Mukul Mishra
screen is visible to me

Raghavendra G V
yes sir

visible

Rabindra Nathak
the comment was about the table only

Raghavendra G V
yes

Sending to WhatsApp
Write Message

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The Chi-square value is

O's	E's	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
50	39	11	121	3.102564
50	65	-15	225	3.461538
30	26	4	16	0.615385
40	45	-5	25	0.555556
70	75	-5	25	0.333333
40	30	10	100	3.333333
30	36	-6	36	1
80	60	20	400	6.666667
10	24	-14	196	8.166667
			Total	27.24

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Chat Participants (26)

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3:98

4

Ravi Chandra Vedula
4.002

Mukul Mathur
4

Ravi Chandra Vedula
Not visible sir

SAGI S joined

Mukul Mathur
screen is visible to me

Raghavendra G V
yes sir

visible

Rabindra Hariakka
the comment was about the table only

Raghavendra G V
yes

Gunasekaran R
Same as Chi square

Sending to everyone
Write Message

10

Observed values [$O_i's$]

Institute	Supported	Against	Neutral	Σ
IITs	50	50	30	130
NITs	40	70	40	150
BITS	30	80	10	120
	120	200	80	400

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The Chi-square value is $\chi^2 = \sum_1^9 \frac{(O-E)^2}{E} = 27.24 = \chi^2_{cal}$

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Decision : we reject the Null hypothesis H_0 at $\alpha = 5\%$ LOS.
i.e, we accept H_1 .

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Chat Participants (25)

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Not visible sir

SAGIS joshi

Mukul Mishra
screen is visible to me

Raghavendra G V
yes sir

visible

Rubendra Marthala
the comment was about this table only

Raghavendra G V
yes

Ganeshkumar B
Same as Chi square

Rubendra Marthala
why is H_0 not the stat that they don't have same opinion; as H_0 should be that proportions are not correlated

not completely Sir

Ganeshkumar B
Here too we Reject

19:59
22-02-2022

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Procedure of Testing of Hypothesis

- Step-1: setup Null hypothesis H_0
- Step-2: setup Alternate hypothesis H_1
- Step-3: Choose appropriate Level of significance (LOS)
- Step-4: Test Statistic
- Step-5: Decision

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SLIDE 4 OF 38 ENGLISH (INDIA)

Chat Participants (25)

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screen is visible to me 1:00 pm

Raghavendra G V yes sir 1:00 pm

visible 1:00 pm

Rubindra Harilaka the comment was about the table only 1:00 pm

Raghavendra G V yes 1:00 pm

Gunasekaran R Same as Chi square 1:00 pm

Rubindra Harilaka why is H_0 not the stmt that they dont have same opinion.. as H_0 should be that proportions are not correlated 1:00 pm

not completely Sir 1:00 pm

Gunasekaran R Here too we Reject 1:00 pm

Ravi Chandra Vedula Here alpha value is used for finding tabular value only not in calculations sir ? 1:00 pm

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9

Problem 1

In order to determine whether 'perfection' in job depends on the 'experience', 400 persons were examined yielding the following data

perfection	Experience		
	Excellent	Good	Satisfactory
High	25	60	29
medium	28	79	60
low	9	45	63

$\alpha < 5\%$
 $\alpha = 0.05$

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NOTE: COMMENTS

67%

Chat

Participants (25)

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Raghavendra G V
yes sir

visible

Rabindra Haralka
the comment was about the table only

Raghavendra G V
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Gunasekaran R
Same as Chi square

Rabindra Haralka
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Gunasekaran R
Here too we Reject

Ravi Chandra Vedula
Here alpha value is used for finding tabular value only not in calculations sir ?

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SLIDE 4 OF 30

ENGLISH (INDIA)

20:00

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Slide 17 of 38

English (INDIA)

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yes sir

visible

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visible

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Here too we Reject

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Here alpha value is used for finding tabular value only not in calculations sir ?

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?

Karl Pearson's Correlation coefficient

Formula for computing Karl Pearson's correlation coefficient (r) is standardised covariance (unit less)

$$r = \frac{\text{Covariance}(x, y)}{\sqrt{\text{Var}(x)}\sqrt{\text{Var}(Y)}}$$

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SLIDE 12 OF 38

ENGLISH (INDIA)

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Problem-3

Find the coefficient of correlation of the following data

X	9	8	7	6	5	4	3	2	1
Y	15	16	14	13	11	12	10	8	9

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SLIDE 20 OF 38 ENGLISH (INDIA)

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Raghavendra G V yes sir 7:55 pm

visible 7:55 pm

Rabindra Haralka the comment was about the table only 7:55 pm

Raghavendra G V yes 7:55 pm

Gurasekaran R Same as Chi square 7:55 pm

Rabindra Haralka why is H0 not the stmt that they dont have same opinion., as H0 should be that proportions are not correlated 7:56 pm

not completely Sir 7:56 pm

Gurasekaran R Here too we Reject 7:56 pm

Ravi Chandra Vedula Here alpha value is used for finding tabular value only not in calculations sir ? 7:56 pm

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Or alternatively we can use

$$r = \frac{\sum XY}{\sqrt{\sum X^2} \sqrt{\sum Y^2}}$$

Where $X = (x - \bar{x})$ and $X^2 = (x - \bar{x})^2$

$Y = (y - \bar{y})$ and $Y^2 = (y - \bar{y})^2$

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Raghavendra G V yes sir 7:55 pm

visible 7:55 pm

Rabindra Haralka the comment was about the table only 7:55 pm

Raghavendra G V yes 7:55 pm

Gurasekaran R Same as Chi square 7:55 pm

Rabindra Haralka why is H0 not the stmt that they dont have same opinion.. as H0 should be that proportions are not correlated 7:56 pm

not completely Sir 7:56 pm

Gurasekaran R Here too we Reject 7:56 pm

Ravi Chandra Vedula Here alpha value is used for finding tabular value only not in calculations sir ? 7:56 pm

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Problem-3

Find the coefficient of correlation of the following data

X	9	8	7	6	5	4	3	2	1
Y	15	16	14	13	11	12	10	8	9

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$$r = \frac{\sum XY}{\sqrt{\sum X^2} \sqrt{\sum Y^2}} = \frac{57}{\sqrt{60} \sqrt{60}} = 0.95$$

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Slide 23 of 38 ENGLISH (INDIA)

Chat Participants (25)

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why is H0 not the stmt that they dont have same opinion.. as H0 should be that proportions are not correlated

not completely Sir.

Gonasekaran R Here too we Reject

Ravi Chandra Vedula Here alpha value is used for finding tabular value only not in calculations sir ?

Raghavendra G V n=9

45

45:9=5

K Girish Gopimathur Shouln't the denomitor be n-1?

As it is sample

Raghavendra G V .95

Mukul Mathur yes

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Problem -4

The following data give the annual income (in thousands of rupees) and amount (in thousands of rupees) of life insurance policies for 10 persons

Annual income	42	58	27	36	70	24	53	47	40	45
Life insurance	150	175	25	75	250	50	250	100	60	50

Calculate correlation coefficient between annual income and life insurance policies?

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not completely Sir

Gunasekaran R
Here too we Reject

Ravi Chandra Vedula
Here alpha value is used for finding tabular value only not in calculations sir ?

Raghavendra G V
n=9

45

45/9=5

K Girish Gopinathan
Shouln't the denomitor be n-1?

As it is sample

Raghavendra G V
.95

Mukul Mathur
yes

high correlation

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Solution:

x	$X' = (x - \bar{x})$	X'^2	y	$Y' = (y - \bar{y})$	Y'^2	XY
42	-0.2	0.04	150	31.5	992.25	12
58	15.8	249.64	175	56.5	3192.25	12
27	-15.2	231.04	25	-93.5	8742.25	4
36	-6.2	38.44	75	-43.5	1892.25	1
70	27.8	772.84	250	131.5	17292.25	0
24	-18.2	331.24	50	-68.5	4692.25	0
53	10.8	116.64	250	131.5	17292.25	4
47	4.8	23.04	100	-18.5	342.25	12
40	-2.2	4.84	60	-58.5	3422.25	12
45	2.8	7.84	50	-68.5	4692.25	
		$\sum X'^2 = 1775.6$			$\sum Y'^2 = 62552.5$	$\sum XY = 8748$

Click to add notes.

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not completely Sir

Gunasakaran R
Here too we Reject

Ravi Chandra Vedula
Here alpha value is used for finding tabular value only not in calculations sir ?

Raghavendra G V
n=9

45

45:9=5

K Girish Gopinathan
Shouldn't the denominator be n-1?

As it is sample

Raghavendra G V
.95

Mukul Mathur
yes

high correlation

PEDDADA CHAKRAVARTHY joined

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$$r = \frac{\sum XY}{\sqrt{\sum X^2} \sqrt{\sum Y^2}} = \frac{8748}{\sqrt{1775.6} \sqrt{62552.5}} = 0.83$$

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Slide 27 of 38 ENGLISH (INDIA)

Chat Participants (28)

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Here alpha value is used for finding tabular value only not in calculations pir ?

Raghavendra G V
n=9

45

45/9=5

K Girish Gopinathan
Shouln't the denomitor be n-1?

As it is sample

Raghavendra G V
.95

Mukul Mathur
yes

high correlation

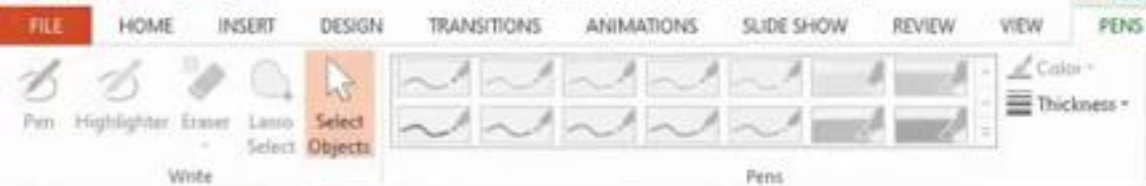
PEDDADA CHARANVARTHY joined

Raghavendra G V
0.83

Ravi Chandra Vedula
High correlation

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Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai	Hyderabad
Average price	65	67
Standard price	2.5	3.5

Correlation coefficient between the prices of commodities in the two cities is 0.8.

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Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai (X)	Hyderabad (Y)
Average price	$65 = \bar{X}$	$67 = \bar{Y}$
Standard price	$2.5 = \sigma_X$	$3.5 = \sigma_Y$

Correlation coefficient between the prices of commodities in the two cities is 0.8.

Sol

Given

$$\bar{X} = 65 \quad ; \quad \overline{\sigma_x} =$$

Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai (X)	Hyderabad (Y)
Average price	$65 = \bar{X}$	$67 = \bar{Y}$
Standard price	$2.5 = \sigma_X$	$3.5 = \sigma_Y$

Correlation coefficient between the prices of commodities in the two cities is 0.8.

Sol: Given $\bar{X} = 65$; $\sigma_x = 2.5$

$$\bar{Y} = 67 ; \sigma_y = 3.5$$

Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai (X)	Hyderabad (Y)
Average price	$65 = \bar{x}$	$67 = \bar{y}$
Standard <u>price</u>	$2.5 = \sigma_x$	$3.5 = \sigma_y$

Correlation coefficient between the prices of commodities in the two cities is 0.8.

Sol: Given $\bar{x} = 65$; $\sigma_x = 2.5$

$$\bar{y} = 67 ; \sigma_y = 3.5$$

Line of regression of y on x is

$$(y - \bar{y}) = r \frac{\sigma_y}{\sigma_x} (x - \bar{x})$$

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Sol: Given $\bar{X} = 65$; $\sigma_x = 2.5$ $r = 0.8$

$\bar{Y} = 67$; $\sigma_y = 3.5$

Line of regression of Y on X is

$$(Y - \bar{Y}) = r \frac{\sigma_y}{\sigma_x} (X - \bar{X})$$

$$Y = \bar{Y} + \left(r \frac{\sigma_y}{\sigma_x} \right) (X - \bar{X})$$

$$Y = 67 + (0.8) \left(\frac{3.5}{2.5} \right) (X - 65)$$

When $X = 70$

$$Y =$$

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45

45/9=5

R-Girish Gopinathan
Shouldn't the denominator be n-1?

As it is sample

Raghavendra G V
.95

Mukul Mathur
yes

high correlation

PEDDADA CHAKRAVARTHY joined

Raghavendra G V
0.83

Ravi Chandra Vedula
High correlation

Ok sir

Raghavendra G V
yes

SATHISHKUMAR M joined

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 $\gamma =$

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Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai (x)	Hyderabad (y)
Average price	65 = \bar{x}	67 = \bar{y}
Standard price	2.5 = σ_x	3.5 = σ_y

Correlation coefficient between the prices of commodities in the two cities is 0.8.

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Mukul Mathur
yes
8:00 pm

high correlation
8:00 pm

PEDDADA CHAKRAVARTHY joined
8:00 pm

Raghavendra G V
0.83
8:14 pm

Ravi Chandra Vedula
High correlation
8:19 pm

Ok sir
8:22 pm

Raghavendra G V
yes
8:22 pm

SATHEESHKUMAR M joined
8:22 pm

ALAGU SANTOSH A joined
8:22 pm

Rubendra Hariloka
You have considered Hyderabad as y.
and price of Hyderabad is given as 70
8:22 pm

So, we have to find x, right? not y
8:22 pm

Raghavendra G V
X=67.68
8:23 pm

WE HAVE TO FIND X SIR
8:23 pm

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Line of regression of Y on X is

Sol: Given $\bar{x} = 65$, $\sigma_x = 2.5$
 $\bar{y} = 67$, $\sigma_y = 3.5$
 $r = 0.8$

Line of regression of X on Y

$$(y - \bar{y}) = r \frac{\sigma_y}{\sigma_x} (x - \bar{x})$$

$$y = \bar{y} + \left(r \frac{\sigma_y}{\sigma_x} \right) (x - \bar{x})$$

$$y = 67 + (0.8) \left(\frac{3.5}{2.5} \right) (x - 65)$$

When $x = 70$
 $y =$

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Chat

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Ravi Chandra Vedula
High correlation

Ok sir

Raghavendra G V
yes

SATHEESHKUMAR M joined

ALADU SANTOSH K joined

Rohindra Harshika
You have considered Hyderabad as y
and price of Hyderabad is given as 70

So, we have to find x, right? not y

Raghavendra G V
X=67.68

WE HAVE TO FIND X SIR

Mukul Mishra
r or 1/r

Rohindra Harshika
If we compare two formulas, they are
not matching up.

yeah, rearranging leads to 1/r

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Problem - 5

Find the mostly likely price in Chennai corresponding to the price of Rs. 70 at Hyderabad from the following

	Chennai (x)	Hyderabad (y)
Average price	$65 = \bar{x}$	$67 = \bar{y}$
Standard price	$2.5 = \sigma_x$	$3.5 = \sigma_y$

Correlation coefficient between the prices of commodities in the two cities is 0.8 .

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Ravi Chandra Vedula
High correlation
6:10 pm

Ok sir
6:10 pm

Raghavendra G V
yes
6:10 pm

SATHEESHKUMAR M joined
6:10 pm

ALAGU SANTOSH A joined
6:10 pm

Rabindra Haralka
You have considered Hyderabad as y, and price of Hyderabad is given as 70.
6:12 pm

So, we have to find x, right? not y
6:12 pm

Raghavendra G V
X=67.68
6:12 pm

WE HAVE TO FIND X SIR
6:12 pm

Mukul Mathva
r or 1/r
6:12 pm

Rabindra Haralka
If we compare two formulas, they are not matching up..
6:12 pm

yeah, rearranging leads to 1/r
6:12 pm

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Sol Given $\bar{x} = 65$; $\sigma_x = 2.5$
 $\bar{y} = 67$; $\sigma_y = 3.5$
 $r = 0.8$

Line of regression of Y on X is

$$(y - \bar{y}) = r \frac{\sigma_y}{\sigma_x} (x - \bar{x})$$

$$y = \bar{y} + \left(r \frac{\sigma_y}{\sigma_x} \right) (x - \bar{x})$$

$$y = 67 + \left(0.8 \right) \left(\frac{3.5}{2.5} \right) (x - 65)$$

When $x = 70$
 $y =$

Line of regression of X on Y

$$(x - \bar{x}) = r \frac{\sigma_x}{\sigma_y} (y - \bar{y})$$

$x =$

Chat Participants (29)

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SATHESHKUMAR M joined

ALAGU SANTOSH A joined

Rabindra Harbalka
 You have considered Hyderabad as y, and price of Hyderabad is given as 70

So, we have to find x, right? not y

Raghavendra G V
 X=67.68

WE HAVE TO FIND X SIR

Mukul Mathur
 r or 1/r

Rabindra Harbalka
 If we compare two formulas, they are not matching up..

yeah, rearranging leads to 1/r

SINDIA P CHOLLAJAL joined

Sir, doubt is choice of x and y was arbitrary.. do we know whether Chennai depends on Hyderabad or vice versa, any such information is not given

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Sol: Given $\bar{x} = 65$; $\sigma_x = 2.5$
 $\bar{y} = 67$; $\sigma_y = 3.5$
 $r = 0.8$

✓ Line of regression of Y on X is
 $(y - \bar{y}) = r \frac{\sigma_y}{\sigma_x} (x - \bar{x})$
 $y = \bar{y} + \left(r \frac{\sigma_y}{\sigma_x} \right) (x - \bar{x})$
 $y = 67 + (0.8) \left(\frac{3.5}{2.5} \right) (x - 65)$
 When $x = 70$
 $y =$

✓ Line of regression of X on Y
 $(x - \bar{x}) = r \frac{\sigma_x}{\sigma_y} (y - \bar{y})$
 $x =$

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X=67.68 8:20 pm

WE HAVE TO FIND X SIR 8:21 pm

Mukul Mathur
r or 1/r 8:22 pm

Rabindra Harilalka
If we compare two formulas, they are not matching up.. 8:24 pm

yeah, rearranging leads to 1/r 8:25 pm

SINDIA P DHOLAKAL joined 8:26 pm

Sir, doubt is choice of x and y was arbitrary.. do we know whether Chennai depends on Hyderabad or vice versa, any such information is not given 8:28 pm

Mukul Mathur
sir these two formulas are not equating with each other 8:28 pm

Ravi Chandra Vedula
Both formulas together are contradicting to each other sir 8:29 pm

Mukul Mathur
is that fine? 8:29 pm

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Problem-6

The two regression lines between x and y are given below. Find \bar{x} , \bar{y} and r.

$$5x - 6y + 90 = 0 \text{ and } 15x - 8y - 130 = 0$$

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Chat Participants (27)

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X=67.68 8:20 pm

WE HAVE TO FIND X SIR 8:20 pm

Mukul Mathur r or 1/r 8:20 pm

Rabindra Harilalka If we compare two formulas, they are not matching up.. 8:20 pm

yeah, rearranging leads to 1/r 8:20 pm

SINDIA P CHOOLACKAL joined

Sir, doubt is choice of x and y was arbitrary.. do we know whether Chennai depends on Hyderabad or vice versa, any such information is not given 8:20 pm

Mukul Mathur sir these two formulas are not equating with each other 8:20 pm

Ravi Chandra Vedula Both formulas together are contradicting to each other sir 8:20 pm

Mukul Mathur is that fine? 8:20 pm

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Problem-6

The two regression lines between x and y are given below. Find \bar{x} , \bar{y} and r . ✓

$$5x - 6y + 90 = 0 \text{ and } 15x - 8y - 130 = 0$$

Sol:

$$5x - 6y + 90 = 0 \Rightarrow 6y = 5x + 90$$

$$\Rightarrow y = \left(\frac{5}{6}\right)x + \left(\frac{90}{6}\right) = ()x + C$$

Regression coe y on x

$$\text{Regression coe } y \text{ on } x \text{ is } = b_{yx} = \frac{5}{6}$$

$$15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130$$

$$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$$

Regression coe. x on $y = b_{xy} = \frac{8}{15}$

$$r = \sqrt{(b_{yx})(b_{xy})} = \sqrt{5/6}$$

or

$$r^2 = (b_{yx})(b_{xy})$$

7 8 - X

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33

15x-8y-130=0 => 15x=8y+130

$$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$$

Regression coe. x on y = $b_{xy} = \frac{8}{15}$

$$r = \sqrt{(b_{yx})(b_{xy})} = \sqrt{\left(\frac{5}{6}\right)\left(\frac{8}{15}\right)}$$

or

$$r^2 = (b_{yx})(b_{xy})$$

=

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NOTE COMMENTS

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15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130

$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$

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or $r^2 = (b_{yx})(b_{xy})$

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Chat Participants (27)

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Sir, doubt is choice of x and y was arbitrary.. do we know whether Chennai depends on Hyderabad or vice versa. any such information is not given

Mukul Mathur
sir these two formulas are not equating with each other

Ravi Chandra Vedula
Both formulates together are contradicting to each other sir

Mukul Mathur
is that fine?

Raghavendra G V
 $y = mx + c$, $m = r(S_x/S_y)$, S_x = Standard deviation of x, S_y = Standard deviation of y.

SAI KUMAR K.C. joined

Kumarash Sen
d should be 130/15?

Raghavendra G V
0.667

Mukul Mathur
.66

Searching in all groups

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15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130

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vice versa, any such information is not given

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SAI KUMAR K C joined

Kumaresh Sen
d should be 130/15?

Raghavendra G V
0.667

Mukul Mathur
.66

Rabindra Hattakka
2/3

Sending to everyone
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28

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33

15x-8y-130=0 => 15x=8y+130

X=(8/15)Y+130=()Y+d

Regression coe. x on y = b_{xy} = 8/15

γ = √(b_{yx}) (b_{xy}) = √(5/6) (8/15)

or

σ² = (b_{yx}) (b_{xy})

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SLIDE 32 OF 38

ENGLISH (INDIA)

NOTESCOMMENTS

20:37

22-02-2022

$$15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130$$

$$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$$

$$\text{Regression coe. } x \text{ on } y = b_{xy} = \frac{8}{15}$$

$$r = \sqrt{(b_{yx})(b_{xy})} = \sqrt{(5/6)(8/15)}$$

or

$$\boxed{r^2 = (b_{yx})(b_{xy})}$$

=

$$15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130$$

$$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$$

Regression coe. x on $y = b_{xy} = \frac{8}{15}$

$$r = \sqrt{(b_{yx})(b_{xy})} = \sqrt{(5/6)(8/15)}$$

or

$$r^2 = (b_{yx})(b_{xy})$$

$$= 0.667 \approx 0.67$$

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(\bar{x}, \bar{y})

$$\left. \begin{aligned} 5\bar{x} - 6\bar{y} + 90 &= 0 \\ 15\bar{x} - 8\bar{y} - 130 &= 0 \end{aligned} \right\} \checkmark$$

$\bar{x} =$

$\bar{y} =$

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vice versa, any such information is not given

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Kumaresw Sen
d should be 130/15 ?

Raghavendra G V
0.667

Mukul Mathur
.66

Rabindra Harshika
2/3

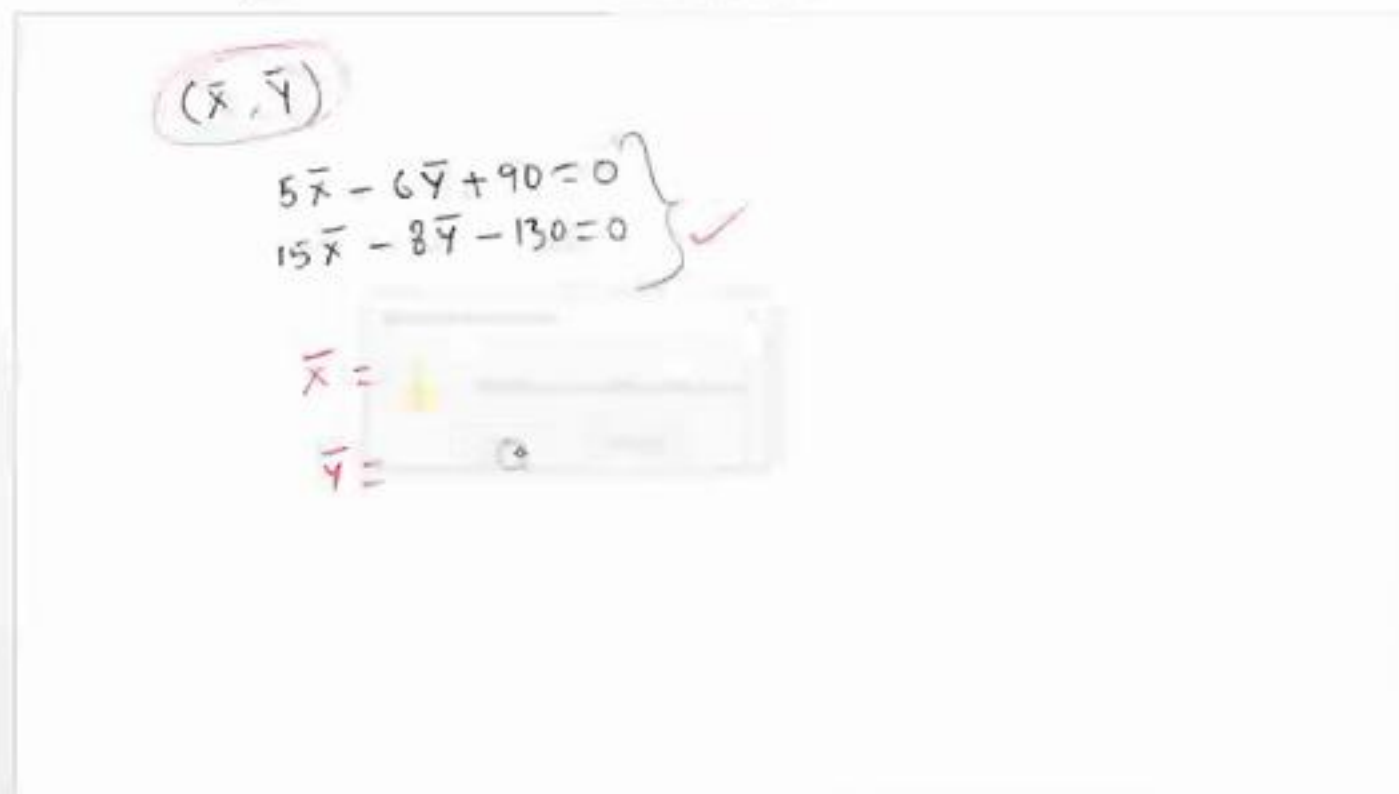
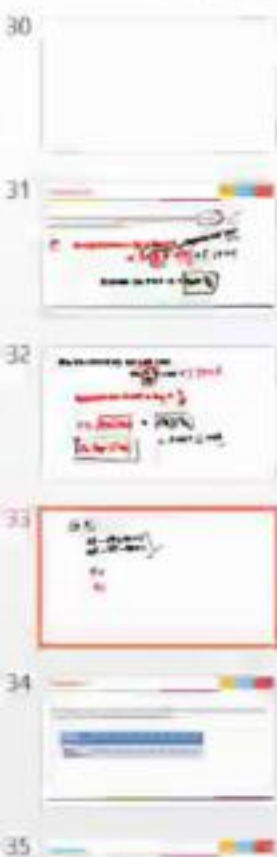
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$$(\bar{x}, \bar{y})$$

$$\left. \begin{aligned} 5\bar{x} - 6\bar{y} + 90 &= 0 \\ 15\bar{x} - 8\bar{y} - 130 &= 0 \end{aligned} \right\} \checkmark$$

$$\bar{x} =$$

$$\bar{y} =$$



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34

35

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SLIDE 35 OF 36 ENGLISH INDIA

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(\bar{x}, \bar{y})

$5\bar{x} - 6\bar{y} + 90 = 0$

$15\bar{x} - 8\bar{y} - 130 = 0$

$\bar{x} =$

$\bar{y} = 40$

$5\bar{x} = 6\bar{y} - 90$

$3(5\bar{x}) = 8\bar{y} + 130$

$3(6\bar{y} - 90) = 8\bar{y} + 130$

$18\bar{y} - 270 = 8\bar{y} + 130$

$10\bar{y} = 270 + 130$

$10\bar{y} = 400$

$\bar{y} = 40$

(\bar{x}, \bar{y})

$$5\bar{x} - 6\bar{y} + 90 = 0$$

$$15\bar{x} - 8\bar{y} - 130 = 0$$

$$5\bar{x} = 6\bar{y} - 90$$

$$3(5\bar{x}) = 8\bar{y} + 130$$

$$3(6\bar{y} - 90) = 8\bar{y} + 130$$

$$18\bar{y} - 270 = 8\bar{y} + 130$$

$$10\bar{y} = 270 + 130$$

$$10\bar{y} = 400$$

$$\boxed{\bar{y} = 40}$$

$$\bar{x} =$$

$$\bar{y} = 40$$

$$15x - 8y - 130 = 0 \Rightarrow 15x = 8y + 130$$

$$x = \left(\frac{8}{15}\right)y + 130 = ()y + d$$

$$\text{Regression coe. } x \text{ on } y = b_{xy} = \frac{8}{15}$$

$$r = \sqrt{(b_{yx})(b_{xy})} = \sqrt{(5/6)(8/15)}$$

or

$$r^2 = (b_{yx})(b_{xy})$$

$$= 0.667 \approx 0.67$$

Problem-7

Distribution of marks in chemistry and mathematics of ten students in a certain test is given below. Find Rank Correlation coefficient.

Marks in chemistry	25	29	32	36	40	32	39	42	40	43
Marks in mathematics	70	80	85	70	75	65	58	65	54	70

Problem-7

innovate

achieve

lead

Distribution of marks in chemistry and mathematics of ten students in a certain test is given below. Find Rank Correlation coefficient.

Marks in chemistry	25	29	32	36	40	32	39	42	40	43
Marks in mathematics	70	80	85	70	75	65	58	65	54	70

Solution:

innovate

achieve

lead

X	Y	R1	R2	d	d^2
25	70	10	5	5	25
29	80	9	2	7	49
32	85	7.5	1	6.5	42.25
36	70	6	5	1	1
40	75	3.5	3	0.5	0.25
32	65	7.5	7.5	0	0
39	58	5	9	-4	16
42	65	2	7.5	-5.5	30.25
40	54	3.5	10	-6.5	42.25
43	70	1	5	-4	16
					222

Solution:

innovate

achieve

lead

M.che M.math *Rank of X*

X	Y	R1	R2	$d = (R_1 - R_2)$	d^2
1	25	70	10	-5	25
2	29	80	9	2	4
3	32	85	7.5	1	1
4	36	70	6	-5	25
5	40	75	3.5	3	9
6	32	65	7.5	0	0
7	39	58	5	4	16
8	42	65	2	7	49
9	40	54	3.5	3	9
10	43	70	1	5	25
					222



$$\frac{7+8}{2} =$$

$$\sum d^2 = 222$$

$$\frac{3+4}{2} = \frac{7}{2} = 3.5$$

$$\frac{1}{2}$$

$$\frac{4+5+6}{3} = \frac{15}{3} = 5$$

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Solution:

in che month

X	Y	R1	R2	$d = (R_1 - R_2)$	d^2
1	25	70	10	5	25
2	27	80	9	2	4
3	32	85	7.5	1	1
4	30	80	8	5	1
5	40	75	6.5	1	0.25
6	32	85	7.5	7.5	0
7	35	58	5	9	18
8	42	60	2	7.5	30.25
9	40	34	3.5	10	42.25
10	43	70	1	5	16
					222

Rank 21

$3+4 = 7$
 $\frac{7}{2} = 3.5$

$4+5+6 = 15$
 $\frac{15}{3} = 5$

$\frac{7+5}{2} = 6$

$\Sigma d^2 = 222$

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Chat

Participants (25)

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0.667

Mukul Mishra
.56

Raghavendra Prasad
2/3

M R VIKAS KATHEKUN, Jodhpur

Raghavendra S V
 $y=40$

$x=30$

Raghavendra Prasad
30: 40

M R VIKAS KATHEKUN, Jodhpur
14

14

sorry

40

$\bar{x}=30$

month number
30

20:51
22-02-2022



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Peru

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ink Art

$$\frac{3+4}{2} = \frac{7}{2} = 3.5$$

$$\frac{4+5+6}{3} = \frac{15}{3} = 5$$

$$\frac{718}{2} = \Sigma d = 222$$

SLIDE 35 OF 38  ENGLISH INDIA

Solution:

ADMINISTRATIVE

ACADEMIC

LEAD

M.che M.math *Rank of X*

	X	Y	R1	R2	$d = (R_1 - R_2)$	d^2
1	25	70	10	5	5	25
2	29	80	9	2	7	49
3	32	85	7.5	1	6.5	42.25
4	36	70	6	5	1	1
5	40	75	3.5	3	0.5	0.25
6	32	65	7.5	7.5	0	0
7	39	58	5	9	-4	16
8	42	65	2	7.5	-5.5	30.25
9	40	54	3.5	10	-6.5	42.25
10	43	70	1	5	-4	16
						222



$$\frac{7+8}{2} =$$

$$\sum d^2 = 222$$

$$\frac{3+4}{2} = \frac{7}{2} = 3.5$$

$$\frac{4+5+6}{3} = \frac{15}{3} = 5$$

$$R = 1 - \frac{6 [\sum d^2 + CF]}{n(n^2 - 1)}$$

$$= 1 - \frac{6 [222 + 3.5]}{10(10^2 - 1)}$$

$$= 1 - 1.36 = \underline{\underline{-0.36}}$$

Solution:

innovate

act fast

lead

M.che M.math \rightarrow Rank of X

X	Y	R1	R2	$d = (R_1 - R_2)$	d^2
1	25	70	10	-5	25
2	29	80	9	-1	1
3	32	85	7.5	-0.5	0.25
4	36	70	6	-1	1
5	40	75	3.5	-3.5	12.25
6	32	65	7.5	-4.5	20.25
7	39	58	5	-3	9
8	42	65	2	-4.5	20.25
9	40	54	3.5	-4.5	20.25
10	43	70	1	-6.5	42.25
					222



$$\frac{7+8}{2} =$$

$$\sum d^2 = 222$$

$$\frac{3+4}{2} = \frac{7}{2} = 3.5$$

1
2
3

in X 32 \rightarrow 2 times
40 \rightarrow 2 times
in Y 65 \rightarrow 2 times
70 \rightarrow 3 times

$$\frac{4+5+6}{3} = \frac{15}{3} = 5$$



Rank Cor. Coef

$$R = 1 - \frac{6 [\sum d^2 + CF]}{n(n^2 - 1)}$$

$$= 1 - \frac{6 [222 + 3.5]}{10(10^2 - 1)}$$

$$= 1 - 1.26 = -0.26$$

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Rank Cor. Coef

$$R = 1 - \frac{6 [\sum d^2 + CF]}{n(n^2 - 1)}$$

$$= 1 - \frac{6 [222 + 35]}{10(10^2 - 1)}$$

$$= 1 - 1.36 = \underline{\underline{-0.36}}$$

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0.667

Mukul Mathur
56

Rubindra Heralika
2/3

M R VIJAY KRISHNAN joined

Raghavendra G V
y=40

x=30

Rubindra Heralika
30, 40

M R Vijay Krishnan
14

-14

sorry

40

Xbar = 30

Harsh Vashishth
30

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For, $\boxed{32}$, $\boxed{40}$, $\boxed{65}$ $m=2$

$$CF = \frac{m(m^2-1)}{12} = \frac{1}{2} = 0.5$$

For, $\boxed{70}$ $m=3$ ✓

$$CF = \frac{m(m^2-1)}{12} = 2$$

$$TCF = 0.5 + 0.5 + 0.5 + 2 = 3.5$$

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Mukul Mathur
56

Rabindra Harilalka
2/3

M R VIJAY KRISHNAN joined

Raghavendra G V
y=40

x=30

Rabindra Harilalka
30, 40

M R Vijay Krishnan
14

14

sorry

40

Xbar = 30

Harsh Vasthikar
30

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