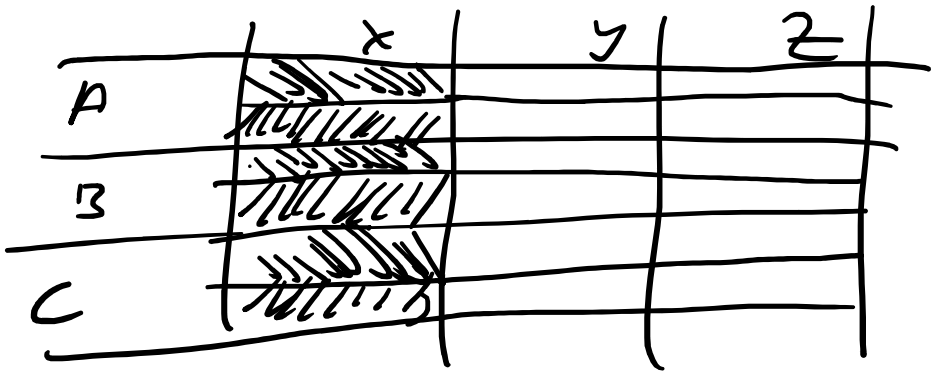
SEST - CO3 - 2024-08-23 - Analyze data for Statistical Estimation and Significance Testing

23 August 2024 09:19

-> ANOVA : More than one observation per cell :



-> Interaction Variation :

Sum of Squared Totals - { SSB_C + SSB_R + SSW }

-> Stepwise ;

i) Correction Factor

ii) Total SS = $\sum x_{ij}^2$ - Correction Factor

iii) $SSB_C = \frac{\sum x_j^2}{n_j}$ - Correction Factor

iv) $SSB_R = \frac{\sum x_i^2}{n_i}$ - Correction Factor

v) $SSW = \sum (x_{ij} - \bar{x}_i)^2 + (x_{ij} - \bar{x}_j)^2$

v) $SSW = \sum (x_{ij_1} - \bar{x})^2 + (x_{ij_2} - \bar{x})^2$

vi) $SSI = SST - [SSB_c + SSB_r + SSW]$

-> Example:

Group of People	Drug X	Drug Y	Drug Z
A	14	10	11
	15	9	11
B	12	7	10
	11	8	11
C	10	11	8
	11	11	7

-> Sol:

i) Correction Factor : $\frac{(T)^2}{n}$

$T = ? \approx 187$

$n = ? \approx \underline{18}$

$= \frac{187 \times 187}{18} = \underline{1942.72}$

ii) $SST = \sum x_{ij}^2 -$ Correction Factor

ii) $SST = \sum x_{ij}^2 - \text{Correction Factor}$

$$= \sum (14)^2 + (15)^2 + (12)^2 + (11)^2 + (10)^2 + (11)^2 + (10)^2 + (9)^2 + (7)^2 + (8)^2 + (11)^2 + (11)^2 + (11)^2 + (11)^2 + (10)^2 + (11)^2 + (8)^2 + (7)^2 \Big] - \frac{187 \times 187}{18}$$

$$= 2019 - 1542.72$$

$$SST = \underline{\underline{76.28}}$$

iii) $SSB_c = \frac{\sum x_j^2}{n_j} - \text{Correction Factor}$

$X = 73 \quad Y = 56 \quad Z = 58$

$$= \left[\frac{73 \times 73}{6} + \frac{56 \times 56}{6} + \frac{58 \times 58}{6} \right] - \left[\frac{187^2}{18} \right]$$

$$SSB_c = \underline{\underline{28.78}}$$

iv) $SSB_{12} = \sum \frac{x_i^2}{} - \text{Correction Factor}$

n_i

$A = 70 \qquad B = 59 \qquad C = 58$

$$= \left[\frac{70 \times 70}{6} + \frac{59 \times 59}{6} + \frac{58 \times 58}{6} \right] - \left[\frac{187^2}{18} \right]$$

$SSB_k = \underline{14.78}$

v) $SSW = \sum (x_{ij_1} - \bar{x})^2 + (x_{ij_2} - \bar{x})^2$

$$= \{ (14-14.5)^2 + (15-14.5)^2 +$$
$$(10-9.5)^2 + (9-9.5)^2 +$$
$$(11-11)^2 + (11-11)^2 +$$
$$(12-11.5)^2 + (11-11.5)^2 +$$
$$(7-7.5)^2 + (8-7.5)^2 +$$
$$(10-10.5)^2 + (11-10.5)^2 +$$
$$(10-10.5)^2 + (11-10.5)^2 +$$
$$(11-11)^2 + (11-11)^2 +$$
$$(8-7.5)^2 + (7-7.5)^2 \}$$

$SSW = \underline{3.50}$

vi) $SSI = SST - [SSB_c + SSB_R + SSW]$

$= 76.28 - [28.78 + 14.78 + 3.5]$

$SSI = \underline{29.23}$

-> D-o-F :

$SSB_c = (c-1)$

$SSB_R = (r-1)$

$SST = (n-1)$

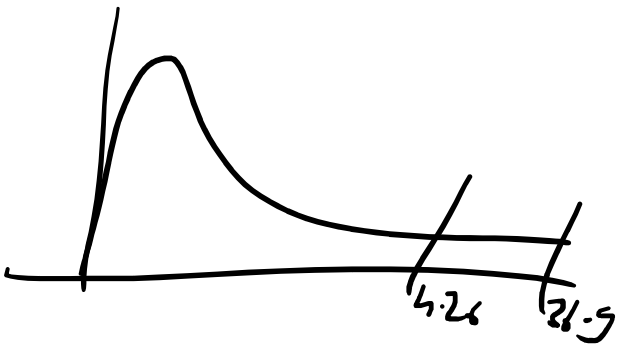
$SSW = SST - [SSB_c + SSB_R + SSI]$

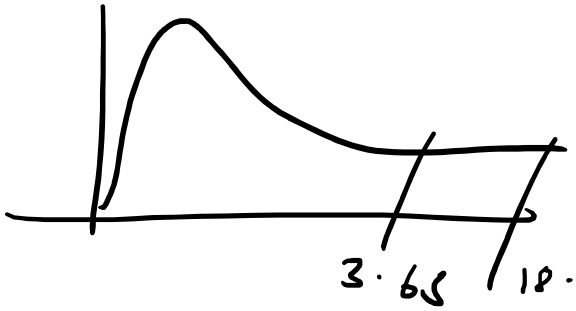
$SSI = SSW_c + SSB_R$

-> ANOVA Table :

Source	SS	DF	MS	F-Ratio	α
B/w cols	28.78	(3-1) = 2	28.78/2 = 14.385	14.385/0.389 = 36.9	F(2,9) = 4.2565
B/w rows	14.78	(3-1) = 2	14.78/2 = 7.39	7.39/0.389 = 19.0	F(2,9) = 4.2565
Interaction	29.23	4	29.23/4 = 7.308	7.308/0.389 = 18.79	F(4,9) = 3.6331
Within samples	3.5	17-2-2-4 = 9	3.5/9 = 0.389		
Total	76.28	(18-1) = 17			

	DF1	α = 0.05																	
DF2	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	Inf
1	161.45	199.5	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	249.05	250.1	251.14	252.2	253.25	254.31
2	18.513	19	19.164	19.247	19.296	19.33	19.353	19.371	19.385	19.396	19.413	19.429	19.446	19.454	19.462	19.471	19.479	19.487	19.496
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8867	8.8452	8.8123	8.7855	8.7446	8.7029	8.6602	8.6385	8.6166	8.5944	8.572	8.5494	8.5264
4	7.7086	6.9443	6.5914	6.3882	6.2561	6.1631	6.0942	6.041	5.9988	5.9644	5.9117	5.8578	5.8025	5.7744	5.7459	5.717	5.6877	5.6581	5.6281
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8759	4.8183	4.7725	4.7351	4.6777	4.6188	4.5581	4.5272	4.4957	4.4638	4.4314	4.3985	4.365
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2067	4.1468	4.099	4.06	3.9999	3.9381	3.8742	3.8415	3.8082	3.7743	3.7398	3.7047	3.6689
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.866	3.787	3.7257	3.6767	3.6365	3.5747	3.5107	3.4445	3.4105	3.3758	3.3404	3.3043	3.2674	3.2298
8	5.3177	4.459	4.0662	3.8379	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.2839	3.2184	3.1503	3.1152	3.0794	3.0428	3.0053	2.9669	2.9276
9	5.1174	4.2565	3.8625	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.0729	3.0061	2.9365	2.9005	2.8637	2.8259	2.7872	2.7475	2.7067
10	4.9646	4.1028	3.7083	3.478	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.913	2.845	2.774	2.7372	2.6996	2.6609	2.6211	2.5801	2.5379
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.948	2.8962	2.8536	2.7876	2.7186	2.6464	2.609	2.5705	2.5309	2.4901	2.448	2.4045
12	4.7472	3.8853	3.4903	3.2592	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.6866	2.6169	2.5436	2.5055	2.4663	2.4259	2.3842	2.341	2.2962
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	2.671	2.6037	2.5331	2.4589	2.4202	2.3803	2.3392	2.2966	2.2524	2.2064
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	2.6022	2.5342	2.463	2.3879	2.3487	2.3082	2.2664	2.2229	2.1778	2.1307
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	2.5437	2.4753	2.4034	2.3275	2.2878	2.2468	2.2043	2.1601	2.1141	2.0658
16	4.494	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	2.4935	2.4247	2.3522	2.2756	2.2354	2.1938	2.1507	2.1058	2.0589	2.0096
17	4.4513	3.5915	3.1968	2.9647	2.81	2.6987	2.6143	2.548	2.4943	2.4499	2.3807	2.3077	2.2304	2.1898	2.1477	2.104	2.0584	2.0107	1.9604
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	2.4117	2.3421	2.2686	2.1906	2.1497	2.1071	2.0629	2.0166	1.9681	1.9168
19	4.3807	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	2.3779	2.308	2.2341	2.1555	2.1141	2.0712	2.0264	1.9795	1.9302	1.878
20	4.3512	3.4928	3.0984	2.8661	2.7109	2.599	2.514	2.4471	2.3928	2.3479	2.2776	2.2033	2.1242	2.0825	2.0391	1.9938	1.9464	1.8963	1.8432
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.366	2.321	2.2504	2.1757	2.096	2.054	2.0102	1.9645	1.9165	1.8657	1.8117
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	2.2967	2.2258	2.1508	2.0707	2.0283	1.9842	1.938	1.8894	1.838	1.7831
23	4.2793	3.4221	3.028	2.7955	2.64	2.5277	2.4422	2.3748	2.3201	2.2747	2.2036	2.1282	2.0476	2.005	1.9605	1.9139	1.8648	1.8128	1.757
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	2.2547	2.1834	2.1077	2.0267	1.9838	1.939	1.892	1.8424	1.7896	1.733
25	4.2417	3.3852	2.9912	2.7587	2.603	2.4904	2.4047	2.3371	2.2821	2.2365	2.1649	2.0889	2.0075	1.9643	1.9192	1.8718	1.8217	1.7684	1.711
26	4.2252	3.369	2.9752	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	2.2197	2.1479	2.0716	1.9898	1.9464	1.901	1.8533	1.8027	1.7488	1.6906
27	4.21	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	2.2043	2.1323	2.0558	1.9736	1.9299	1.8842	1.8361	1.7851	1.7306	1.6717
28	4.196	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.236	2.19	2.1179	2.0411	1.9586	1.9147	1.8687	1.8203	1.7689	1.7138	1.6541
29	4.183	3.3277	2.934	2.7014	2.5454	2.4324	2.3463	2.2783	2.2229	2.1768	2.1045	2.0275	1.9446	1.9005	1.8543	1.8055	1.7537	1.6981	1.6376
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	2.1646	2.0921	2.0148	1.9317	1.8874	1.8409	1.7918	1.7396	1.6835	1.6223
40	4.0847	3.2317	2.8387	2.606	2.4495	2.3359	2.249	2.1802	2.124	2.0772	2.0035	1.9245	1.8389	1.7929	1.7444	1.6928	1.6373	1.5766	1.5089
60	4.0012	3.1504	2.7581	2.5252	2.3683	2.2541	2.1665	2.097	2.0401	1.9926	1.9174	1.8364	1.748	1.7001	1.6491	1.5943	1.5343	1.4673	1.3893
120	3.9201	3.0718	2.6802	2.4472	2.2899	2.175	2.0868	2.0164	1.9588	1.9105	1.8337	1.7505	1.6587	1.6084	1.5543	1.4952	1.429	1.3519	1.2539
Inf	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8799	1.8307	1.7522	1.6664	1.5705	1.5173	1.4591	1.394	1.318	1.2214	1





All H_0 is rejected

$\therefore$ We conclude that drugs acts differently as

∴ We conclude that drug acts differently as well as different groups of people are affected differently as well as the interaction term is significant.