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Class-Statistics
Year Two-Veterinary Medicine

Analysis of Variance (ANOVA)

1-One Way Anova

The F test: compare two variance or more than two means of three conditions. For example, given different doses for two groups and left one group as a control group (become three). It has been used widely in an experimental study in veterinary medicine and agriculture. e.g: feeding a poultry with three types of diet to find out the difference of effects protein concentration on performance of chicken in an observed period of time.

Below is example to clarify this test:

Example

Group 1	Group 2	Group 3
1	2	2
2	4	3
5	2	4

Q//Do ANOA analysis to find the differences between these group.

- Accepted null hypothesis (H_0) if will be no differences between the groups but you will do not accept the hypothesis by switching to alternative when there are significant differences between group (one of them has prominent effect).

You should do five steps for this analysis:

1- Step 1

Degree of freedom

Df between=G-1 3-1=2

Df within=N-1 9-3=6

Go to the F table to find *F critical value* which is "5.14"

Mean of each group

μ_1=2.67

μ_2= 2.67

μ_3=3.00

2- Step 2

Calculate grand mean

Grand mean= sum of data/N

25/9= 2.78

3- Step 3
Calculate sum of square total (SS_{total})

$SS_{total}=\Sigma(x-\bar{x})^2$
$=(1-2.78)^2+(2-2.78)^2+(5-2.78)^2+(2-2.78)^2+(4-2.78)^2+(2-2.78)^2+(2-2.78)^2+(3-2.78)^2+(4-2.78)^2$
=13.6

$SS_{within}=\Sigma(x-\bar{x})^2$

$=(1-2.67)^2+(2-2.67)^2+(5-2.67)^2+(2-2.67)^2+(4-2.67)^2+(2-2.67)^2+(2-3.00)^2+(3-3.00)^2+(4-3.00)^2$
=**13.3**

$SS_{between}$=13.6-13.34=**0.3**

4- Step 4
Calculate variance between ($\mu s_{between}$)

$= SS_{between}/df_{between}$
=0.3/2
=0.13

$= SS_{within}/df_{within}$
13.3/6= 2.21

5- Step calculate ***F*** statistics for this test
$=\mu_{between}/\mu_{within}$
0.13/2.21=**0.05**

- To compare F table we got initially and F calculated in the final step, then concluded 0.05<5.14 which is no significant indication in the test results.

Table A.5a Percentage points of the *F*-distribution ($P = 0.05$ and $P = 0.01$).

df denominator, v_2	*P*	*df* numerator, v_1										
		1	2	3	4	5	6	7	8	12	24	∞
1	0.05	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	243.9	249.1	254.3
	0.01	**4052**	**5000**	**5403**	**5625**	**5764**	**5859**	**5928**	**5981**	**6106**	**6235**	**6366**
2	0.05	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.41	19.45	19.50
	0.01	**98.50**	**99.00**	**99.17**	**99.25**	**99.30**	**99.33**	**99.36**	**99.37**	**99.42**	**99.46**	**99.50**
3	0.05	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.74	8.64	8.53
	0.01	**34.12**	**30.82**	**29.46**	**28.71**	**28.24**	**27.91**	**27.67**	**27.49**	**27.05**	**26.60**	**26.13**
4	0.05	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	5.91	5.77	5.63
	0.01	**21.20**	**18.00**	**16.69**	**15.98**	**15.52**	**15.21**	**14.98**	**14.80**	**14.37**	**13.93**	**3.46**
5	0.05	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.68	4.53	4.36
	0.01	**16.26**	**13.27**	**12.06**	**11.39**	**10.97**	**10.67**	**10.46**	**10.29**	**9.89**	**9.47**	**9.02**
6	0.05	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.00	3.84	3.67
	0.01	**13.75**	**10.92**	**9.78**	**9.15**	**8.75**	**8.47**	**8.26**	**8.10**	**7.72**	**7.31**	**6.88**
7	0.05	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.57	3.41	3.23
	0.01	**12.25**	**9.55**	**8.45**	**7.85**	**7.46**	**7.19**	**6.99**	**6.84**	**6.47**	**6.07**	**5.65**
8	0.05	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.28	3.12	2.93
	0.01	**11.26**	**8.65**	**7.59**	**7.01**	**6.63**	**6.37**	**6.18**	**6.03**	**5.67**	**5.28**	**4.86**
9	0.05	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.07	2.90	2.71
	0.01	**10.56**	**8.02**	**6.99**	**6.42**	**6.06**	**5.80**	**5.61**	**5.47**	**5.11**	**4.73**	**4.31**
10	0.05	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	2.91	2.74	2.54
	0.01	**10.04**	**7.56**	**6.55**	**5.99**	**5.64**	**5.39**	**5.20**	**5.06**	**4.71**	**4.33**	**3.91**
12	0.05	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.69	2.51	2.30
	0.01	**9.33**	**6.93**	**5.95**	**5.41**	**5.06**	**4.82**	**4.64**	**4.50**	**4.16**	**3.78**	**3.36**
14	0.05	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.53	2.35	2.13
	0.01	**8.86**	**6.51**	**5.56**	**5.04**	**4.69**	**4.46**	**4.28**	**4.14**	**3.80**	**3.43**	**3.00**