PARAMETRIC AND NON-PARAMETRIC TEST

Statistical tests can be split into two categories.

(i) Parametric tests

(ii) Non-parametric tests.

Parametric tests

(i) Test for Normality

Every data must follow certain distribution. But we have to find the appropriate distribution from goodness of fit test. So, our data is checked through each and every distribution. Hence, goodness of fit test is very tedious. This way of estimation of data is called by parametric tests. Parametric tests always give the reliable estimated value.

If the data follow the normal distribution, then we can use parametric statistical tests. According to the central limit theorem, if the sample size is large, all data must follow the normal distribution.

List of parametric tests and their usage?

Independent sample t test – Compare means between two groups

Paired sample t test – Compare means between related groups

ANOVA – Compare the means between two or more distinct groups

Pearson correlation coefficient – Relationship between two variables.

Independent sample t-test

Independent sample t test is used to find out whether the mean of two unrelated groups (independent variable) are equal or not based on the same dependent variable. The data should be in the following format.

- Independent variable must be in categorical data
- Dependent variable should be measured on a continuous scale (interval or ratio)

- The data should contain without outliers. Outlier means a value(s) which is deviate from the whole data.
- The data should follow approximately normally distributed for each of the group of independent variable.
- The variability within the independent variable is not distinct.

What are the values are extracting from this test and their usage?

- F-value and p-value for Levene's test are used to test the homogeneity of variances within two group of independent variable. Here p-value must be greater than 0.05, then we conclude that the two groups' variance are same.
- Descriptive statistic (Mean, SD and SE) for two groups based on the dependent variable.
- t-value and p-value for t test are used for compare the mean of two groups based on dependent variable.

Sample work

Table 1: Comparison of Mean Spherical equivalent of the amblyopic and non-amblyopic eyes for different groups

Groups	Refractive Error (D)		P value
	Mean±SD		
	Normal	Amblyopic	
Hyperopic Anisometropia	0.7±1.4	3.9±1.8	**0.000****
Myopic Anisometropia	-0.8±1.3	-3.3±1.4	**0.000****
Sensory	-0.0±0.8	0.0±1.6	0.866
Strabismus	-0.1±1.3	-0.5±1.9	0.551

SD- Standard deviation ** denotes P<0.01; * P<0.05

Table 1 presents the mean spherical equivalent of the amblyopic and non-amblyopic eyes for different groups. In hyperopic anisometropia, the mean spherical equivalent is higher in Amblyopic eyes (3.9±1.8) while patients with normal eye had the lowest mean spherical equivalent (0.7±1.4) (P<0.00). And in myopic anisometropia the mean spherical equivalent is higher in Amblyopic eye (-3.3±1.4) while patients with normal eye had the lowest mean

spherical equivalent (-0.8±1.3) (P=0.00). There is no statistically significant difference in the mean spherical equivalent for sensory and Strabismus Amblyopia and their fellow eye.

Oneway-ANOVA

Oneway – ANOVA is one of the mean comparison test. This test is used to ascertain whether the mean of more than two groups (independent variable) are equal or not based on the dependent variable. The data should satisfy the following conditions:

Independent variable must be in categorical data

Dependent variable should be measured on a continuous scale (interval or ratio)

The data should contain without outliers. Outlier means a value(s) which is deviate from the whole data.

The data should follow approximately normally distributed for each of the group of independent variable.

The variability within the independent variable is not distinct.

What are the values are extracting from this test and their usage?

Descriptive statistic (Mean, SD and SE) for groups based on the dependent variable.

F-value and p-value are used to compare the mean values between the groups of independent variable.

Multiple comparison tests give the information about whether combinations of two groups' means are equal.

Sample Work

Table 2: Difference in mean score between different methods

	Control (n=48)	New method (n=49)	Standard method (n=48)	F-value	p-value
	Mean±SD				
Score	5.25±1.92	6.04±1.79	5.33±1.53	2.981	0.054*

*p<0.05

Table 2 reveals the difference in mean scores between different methods was analyzed using analysis of variance (ANOVA). Since F-value is 2.981 and p-value is 0.054 which is borderline in, hence reject the null hypothesis. In Student score, new method has high mean (6.04) compared to standard method (5.33) and control (5.25). Thus we conclude the hypotheses

Paired sample t test

Paired sample t test is used to find out whether the mean of two related groups (independent variable) are equal or not based on the same dependent variable. Here related group data means data is gathered from same participants, but different time period. The data should be in the following format.

Independent variable must be in categorical data

Dependent variable should be measured on a continuous scale (interval or ratio)

The data should contain without outlier. Outlier means a value which is deviate from the whole data.

The distribution of the difference in the dependent variable between two related groups should be approximately normal distribution.

What are the values are extracting from this test and their usage?

Descriptive statistic (Mean, SD and SE) for two groups based on the dependent variable.

tvalue and p-value for t test are used for compare the mean of two related groups based on dependent variable.

Table 3: Paired t-test analysis for experimental group and control group to Subject-verb-object

Group	Baseline test	Mean Score	Mean Difference (MD)	t-test	p- value
Experimental	0.1	0.13	-0.03	-3.2	**0.016***
Control	0.1	1	-0.9	-1.9	0.058

*Experimental =Song teaching method; control=standard teaching method, $p<0.05$

Table 3 presents a comparison of the subject verb object scores of the students who have been given song and standard as a method of teaching. The results revealed that the baseline scores (M=0.1) was significantly improved after song (M=0.1) as a method of teaching with a

mean difference value (-0.03, p=0.016). However, the control groups although showed significant the effect was lower than the song method of teaching (Baseline=0.1; M=1; MD=-0.9, p=0.058).

Non-parametric tests

Non-parametric tests do not have any assumption like parametric tests. So it called by distribution free test.

List of non-parametric tests and their usage?

Mann-Whitney U test – Compare mean rank between two groups

Friedman test – Compare mean rank between three or more related groups

Kruskal-Wallis test – Compare the mean rank between two or more distinct groups

Spearman's rank correlation – Relationship between two variables.

Friedman test

Table 4: Friedman test for engage bank offers via social media or net-working sites

Ranks	
	Mean Rank
Alert me about new products relevant to my needs	4.53
Notify about promotional offers or discounts	4.58
Offer faster customer service	5.37
Let me read customer reviews and product rankings	4.49
Reward me for recommending the brand	4.43
Post educational information about personal finance	4.44
Let me post opinion on current products/services	4.09
Invite me to submit ideas for new product/service and acknowledge /reward me as a valued contributor	4.07

P-value= 0.000

Friedman test was applied to identify engage bank offers via social media or net-working sites. Table 4 presents the findings of Friedman tests, which ranks bank offers via social media or net-working sites as recorded by survey participants. It is observed that 'Offer faster customer service ranked high by the survey participants with the mean ranking of 5.37. However, they ranked poor (low) for the question 'Invite me to submit ideas for new product/service and acknowledge /reward me as a valued contributor' of 4.07. While, the difference between these

factors is significant, at p=0.000. Hence, it can be concluded that there is significant difference within the mean rank.

Mann-Whitney U test

Table 5: Comparison of % of fatty acid and gender

	Sex	N	Mean Rank	Mann-Whitney U Value	p-value
% of FA in terms of total FA	Female	10	10.40	49.00	0.940 (NS)
	Male	10	10.60		
	Total	20			

NS- Not Significant

Table 5 presents the difference in the mean of fatty acid between male and female. The obtained p-value for the % of FA in terms of total fatty acid is 0.940 which is greater than 0.05. Hence there is no statistically significant difference in the mean rank between male and female.

Kruskal Wallis Test

Table 6: Kruskal Wallis test engage bank offers via social media or net-working sites for different segments

Ranks				P-value
	Segment	N	Mean Rank	
Alert me about new products relevant to my needs	Professionals	65	79.03	0.126
	Student/Young professionals	51	66.99	
	Homemaker	36	85.40	
	Total	152		
Notify about promotional offers or discounts	Professionals	65	71.81	0.517
	Student/Young professionals	51	80.14	
	Homemaker	36	79.82	
	Total	152		
Offer faster customer service	Professionals	65	78.01	0.832
	Student/Young professionals	51	77.24	
	Homemaker	36	72.74	
	Total	152		
Let me read customer reviews and product rankings	Professionals	65	75.56	0.137
	Student/Young professionals	51	69.42	

	Homemaker	36	88.22	
	Total	152		
	Professionals	65	69.26	
Reward me for recommending the brand	Student/Young professionals	51	79.33	0.168
	Homemaker	36	85.56	
	Total	152		
Post educational information about personal finance	Professionals	65	74.62	0.899
	Student/Young professionals	51	77.79	
	Homemaker	36	78.07	
	Total	152		
Let me post opinion on current products/services	Professionals	65	80.98	0.535
	Student/Young professionals	51	74.01	
	Homemaker	36	71.93	
	Total	152		
Invite me to submit ideas for new product/service and acknowledge /reward me as a valued contributor	Professionals	65	74.98	0.914
	Student/Young professionals	51	76.84	
	Homemaker	36	78.76	
	Total	152		

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. It is considered the nonparametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups.

The mean rank (i.e., the "**Mean Rank**" column in the **Ranks** table) can be used to compare with different segments. A Kruskal-Wallis H test showed that there is no significant difference in the mean rank since (P>0.05). Table 6.