IVth SEMESTER B.SC PSYCHOLOGY

CALICUT UNIVERSITY

STATISTICAL TECHNIQUES FOR PSYCHOLOGY

Prepared by

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SYLLABUS

SEMESTER IV

STA 4C 02- STATISTICAL TECHNIQUES FOR PSYCHOLOGY

Contract Hours per week: 5

Number of credits: 3

Number of Contact Hours: 90

Course Evaluation: External 60 Marks+ Internal 15 Marks

Duration of Exam: 2 Hours

Objectives

1. To make the students aware of various Statistical test in different areas of Psychology

2. To give knowledge about applications of Statistics in different areas of Psychological studies.

Module 1: Analysis of Variance- assumptions, One-way and Two-way Classification with Single Observation per Cell, Critical Difference

Module 2: Non Parametric tests- Chi-square Test of Goodness of Fit, Test of Independence of Attributes, Test of Homogeneity of Proportions

Module 3: Sign Test- Wilcoxon's Signed Rank Test, Wilcoxon's Rank Sum Test, Run Test and Krushkal-Wallis Test

Module 4: Factorial Design- Basics of factorial Design, Factorial experiments and their uses in Psychological studies, Concepts of factorial experiments (without derivation), simple problems

Module 5: Preparation of Questionnaire- Scores and Scales of Measurement, Reliability and Validity of Test Scores

MODULE I

ANALYSIS OF VARIANCE

INTRODUCTION

The analysis of variance is a powerful statistical tool for testing the significance of equality of means of populations which are normally distributed. The test of significance based on *t distribution* is an adequate procedure only for testing the difference between two population **means.**

Variance ratio test (F-test)

Statistical test applied in Analysis of variance is F-test. His sample means are equal or samples belong to the population with same variance. The test statistic is "F" which is the ratio between variances. If the test statistic is less than the corresponding table value of F, we accept the null hypothesis. In that case we conclude that samples do not differ significantly or both the samples belong to the population with same variances.

Assumptions in Analysis of Variance

L Population from which samples have been drawn are normally dis

tributed. 2 Populations from which the samples are drawn have same variance.

3. The observations, in the sample, are randomly selected from the

population

4. The observations are non correlated random variables.

5. Any observation is the sum of the effects of the factors influencing it 6. The random errors are normally distributed with mean 0 and a common variance, o 2.

Characteristics of Analysis of Variance

1. It makes statistical analysis of variances of two or more samples

2. It tests whether the difference in the means of different samples is due to chance or due to any significant cause.

3. It uses the statistical test called F - test by finding the appropriate variance ratio.

One way classifications of data

In one way classification, observations are classified into groups on the basis of a single criterion.

Two way classification of data

Two way classification, observations are classified into groups on the basis of two criteria:

Types of Variances

Types of Variances in one way classification:

(a) Variance between samples

(b) Variance within the sample

(c) Variance about the sample (Total variance for all observations to

gether)

Types of variances in two way classification

(a) Variance between samples due to column variable.

(b) Variance between samples due to row variable

(c) Variance within the samples

(d) Variance about the samples (Total variance for all observations together).

ONE WAY ANALYSIS OF VARIANCE

1.Assume that the means of the samples are equal ie the effects of all

factors are equal. (ie, a, a,

2 Compute Mean square between the samples say MSC and Mean square within the sample say MSE For computing MSC and MSE, following calculations are made

@Tsum of all the observations in rows and columns.

(ii) SST-sum of squares of all observations -

(ii) SSC - (Ex)+(Ex where Ex, Ex ……are the column totals.

(iv) SSE SST-SSC

(v). Then calculate: MSC-SS where k is the number of columns

(vi) Calculate: MSE-SE N-k

3. MSE Calculate F-ratio= MSC

4. Obtain the table value of F for (k-1, N-k) degrees of freedom. If

the calculated value of F is less than table value, accept the hypoth esis that the sample means are equal. That is, we conclude that the factors influence in the same manner.

"ANOVA TABLE'

'ANOVA' table presents the various results obtained while carrying the Analysis of Variance.

A specimen of an ANOVA table in one way classification is given below.

Source of variation	Sum of squares	degree of freedom	Mean square
Between Samples	SSC	K - 1	MSC
Within samples	SSE	N - k	MSE
Total	SST	N - 1	

TWO WAY ANALYSIS OF VARIANCE

Procedure for carrying out the two way analysis of Variance 1. (a) Assume means of all columns are equal.

(b) Assume means of all rows are equal.

2 Compute T- Sum of all the values.

3 Find: SST-sum of squares of all observations-T2/ N

4 Find: SSC =$Ex1^2$ +$Ex2^2$-T^2/N where Σx1, Ex_2...are column totals.

5. Find SSR

6 Find: SSE SST-SSC-SSRS

7. Find: MSC =SSC/ (c-1), MSR= SSR/(r-1), MSE= SSE/(C-1(r-1)

where 'c' is the number of columns and 'r' is the number of rows

8. Find Fc= MSC /MSE

Find: Fe = and FR MSE Degree of freedom for Fc-[c-1, (c-1)x (r-1)] Degree of freedom for FR=[r-1, (c-1)x (r-1)] F. is for columnwise and FR is for rowwise comparison

If F. <table value of F, then aa_2 =.

If FR<table value of F, then B, B2=

CODING

Coding in ANOVA is a technique employed to reduce the difficulties in calculations when the observations are large in magnitude. It is also known as short cut method. We substract a constant quantity from all observations to make them smaller

ANOVA AND t TEST

The basic relationship between t statistic is and F ratio is that t^2 =F. The t statistic compares distance. On the other hand F test compares variances.

POST HOC TEST

Post hoc tests are an integral part of ANOVA. When you use ANOVA to test the equality of at least three group means, statistically significant results indicate that not all of the group means are equal. However, ANOVA results do not identify which particular differences between pairs of means are significant.

FISHER LEAST SIGNIFICANT DIFFERENCE

Fisher's least significant difference (LSD) procedure is a two-step testing procedure for pairwise comparisons of several treatment groups. In the first step of the procedure, a global test is performed for the null hypothesis that the expected means of all treatment groups under study are equal. If this global null hypothesis can be rejected at the pre-specified level of significance, then in the second step of the procedure, one is permitted in principle to perform all pairwise comparisons at the same level of significance (although in practice, not all of them may be of primary interest).

CRITICAL DIFFERENCE FOR THE ONEWAY ANOVA

Critical Difference is used to compare means of different treatments that have an equal number of replications.

BONFERRONI TEST

The Bonferroni test is a type of multiple comparison test used in statistical analysis. When performing a hypothesis test with multiple comparisons, eventually a result could occur that appears to demonstrate statistical significance in the dependent variable, even when there is none.

SCHEFFE'S TEST

A Scheffé test is a statistical test that is a post-hoc test used in statistical analysis. It was named after American statistician Henry Scheffé. The Scheffé test is used to make unplanned comparisons, rather than pre-planned comparisons, among group means in an analysis of variance (ANOVA) experiment.

- A Scheffé test is a kind of post-hoc, statistical analysis test that is used to make unplanned comparisons.

- The test was named after American statistician Henry Scheffé.
- The Scheffé test is used to make unplanned comparisons, rather than pre-planned comparisons, among group means in an analysis of variance (ANOVA) experiment.
- The Scheffé test has the advantage of giving the experimenter the flexibility to test any comparisons that appear interesting.
- A drawback of the Scheffé test is that the test has relatively lower statistical power than tests that are designed for pre-planned comparisons.

MODULE II

CHI SQUARE TEST

Chi square test is the statistical test that is used to compare the observed results with the results that were expected. Basically, this test is for you to know if the difference between the observed results and expected results is by any chance or if it is due to the relationship between the variables that you are specially studying. Thus this chi-square test is the best test that will help you to understand and interpret the relationship between the two categorical variables

Chi Square Method

There are basically two types of chi square method.

The test of independence: This test asks you questions based on relationships such as "Does a relationship between gender and SAT scores exist"?

The goodness-of-fit test: This will ask you questions like "if a coin is being tossed 100 times, is there any chance of 50 time here

Chi square distribution formula can be written as:

$\mathbf{x^2_c \sum (O_i - E_1)^2 / E_i}$

Where, c is the chi square test degrees of freedom, O is the observed value(s) and E is the expected value(s).

A**SSUMPTIONS OF CHI SQUARE TEST**

A Chi-Square test of independence is used to determine whether or not there is a significant association between two categorical variables.

This test makes four assumptions:

Assumption 1: Both variables are categorical.

It's assumed that both variables are categorical. That is, both variables take on values that are names or labels.

Assumption 2: All observations are independent.

It's assumed that every observation in the dataset is independ That is, the value of one observation in the dataset does not affect the value of any other observation.

Assumption 3: Cells in the contingency table are mutually exclusive.

It's assumed that individuals can only belong to one cell in the contingency table. That is, cells in the table are mutually exclusive – an individual cannot belong to more than one cell.

Assumption 4: Expected value of cells should be 5 or greater in at least 80% of cells.

CHISQUARE TEST FOR GOODNESS OF FIT

A Chi-Square goodness of fit test is used to determine whether or not a categorical variable

follows a hypothesized distribution.

Chi-Square Goodness of Fit Test: Formula

A Chi-Square goodness of fit test uses the following null and alternative hypotheses:

- H_0: (null hypothesis) A variable follows a hypothesized distribution.
- H_1: (alternative hypothesis**)** A variable does not follow a hypothesized distribution.

We use the following formula to calculate the Chi-Square test statistic X^2:

$$X^2 = \Sigma(O-E)^2 / E$$

where:

- **Σ:** is a fancy symbol that means "sum"
- **O:** observed value
- **E:** expected value

If the p-value that corresponds to the test statistic X^2 with n-1 degrees of freedom (where n is the number of categories) is less than your chosen significance level (common choices are 0.10, 0.05, and 0.01) then you can reject the null hypothesis**.**

TEST OF INDEPENDENCE OF ATTRIBUTES

A **Chi-Square Test of Independence** is used to determine whether or not there is a significant association between two categorical variables.

TEST OF HOMOGENEITY OF PROPORTION

Chi Square used for three different tests:

*Test for Homogeneity of Proportions Used to test if different populations have the same proportion of individuals with some characteristic.

*Goodness of Fit Used to test whether a frequency distribution fits an expected distribution

*Test for Independence used To test the independence of two variables. You can determine whether the occurrence of one variable affects the probability of the occurrence of the other variable.

Test for Homogeneity of Proportions More than two parameters: p1 , p2 , p3 , p4 , p5 ,, pn

1) Hypothesis H 0 : p1= p2=p3== pn
2) H 1 : The population's proportions are not all equal
3) Collect data
4) To find p-value: 2 cdf 2 ,∞ , c−1 where 2=∑ Oi−Ei 2 Ei
5) 4 Decision: Reject H 0 if p-value is less than or equal to Note: If we reject the null hypothesis, then we can conclude that not all populations proportions are not equal

MODULE III

NONPARAMETRIC TEST

In statistics, nonparametric tests are methods of statistical analysis that do not require a distribution to meet the required assumptions to be analyzed (especially if the data is not normally distributed). Due to this reason, they are sometimes referred to as distribution-free tests.

SIGN TEST

The sign test is used to test the null hypothesis that the median of a distribution is equal to some value. It can be used a) in place of a one-sample t-test b) in place of a paired t-test or c) for ordered categorial data where a numerical scale is inappropriate but where it is possible to rank the observations.

Procedure for carrying out the sign test

The observations in a sample of size n are x1, x2, . . . , xn (these observations could be paired differences); the null hypothesis is that the population median is equal to some value M. Suppose that r + of the observations are greater than M and r − are smaller than M (in the case where the sign test is being used in place of a paired t-test, M would be zero). Values of x which are exactly equal to M are ignored; the sum r + + r − may therefore be less than n — we will denote it by n 0 . Under the null hypothesis we would expect half the x's to be above the median and half below. Therefore, under the null hypothesis both r + and r − follow a binomial distribution with p = 1 2 and n = n 0 . The test procedure is as follows:

1. Choose r = max(r −, r+).

2. Use tables of the binomial distribution to find the probability of observing a value of r or higher assuming p = 1 2 and n = n 0 . If the test is one-sided, this is your p-value.

3. If the test is a two-sided test, double the probabililty obtained in (2) to obtain the p value

Significance testing

Since the test statistic is expected to follow a binomial distribution, the standard binomial test is used to calculate significance. The normal approximation to the binomial distribution ***can be used for large sample sizes, m > 25.***

The left-tail value is computed by Pr(W ≤ w), which is the p-value *for the alternativ*e H_1: $p < 0.50$. This alternative means that the *X* measurements tend to be higher.

The right-tail value is computed by Pr($W \geq w$), which is the p-value for the alternative H_1: $p > 0.50$. This alternative means that the Y measurements tend to be higher.

For a two-sided alternative H_1 the p-value is twice the smaller tail-value.

WILCOXON'S SIGNED RANK TEST

Wilcoxon signed-rank test, also known as Wilcoxon matched pair test is a non-parametric hypothesis test that compares the median of two paired groups and tells if they are identically distributed or not. We can use this when: Differences between the pairs of data are non-normally distributed

The **Wilcoxon Signed Rank Test** is the non-parametric version of the paired t-test. It is used to test whether or not there is a significant difference between two population means.

Steps

Step 1: State the null and alternative hypotheses.

H_0: The median difference between the two groups is zero.

H_A: The median difference is negative.

Step 2: Find the difference and absolute difference for each pair.

Step 3: Order the pairs by the absolute differences and assign a rank from the smallest to largest absolute differences. ***Ignore pairs that have an absolute difference of "0" and assign mean ranks when there are ties.***

Step 4: Find the sum of the positive ranks and the negative ranks.

Step 5: Reject or fail to reject the null hypothesis.

WILCOXON SIGNED RANK SUM TEST

The Wilcoxon test, which can refer to either the rank sum test or the signed rank test version, is a nonparametric statistical test that compares two paired groups. The tests essentially calculate the difference between sets of pairs and analyze these differences to establish if they are statistically significantly different from one another.

- The Wilcoxon test compares two paired groups and comes in two versions, the rank sum test, and signed rank test.
- The goal of the test is to determine if two or more sets of pairs are different from one another in a statistically significant manner.
- Both versions of the model assume that the pairs in the data come from dependent populations, i.e., following the same person or share price through time or place.

KRUSHKAL WALLIES TEST

A **Kruskal-Wallis test** is used to determine whether or not there is a statistically significant difference between the medians of three or more independent groups.

This test is the nonparametric equivalent of the one-way ANOVA and is typically used when the normality assumption is violated.

The Kruskal-Wallis test does not assume normality in the data and is much less sensitive to outliers than the one-way ANOVA.

Kruskal-Wallis Test Assumptions

Before we can conduct a Kruskal-Wallis test, we need to make sure the following assumptions are met:

1. Ordinal or Continuous Response Variable – the response variable should be an ordinal or continuous variable. An example of an ordinal variable is a survey response question measured on a Likert Scale (e.g. a 5-point scale from “strongly disagree” to “strongly agree”) and an example of a continuous variable is weight (e.g. measured in pounds).

2. Independence – the observations in each group need to be independent of each other. Usually a randomized design will take care of this.

3. Distributions have similar shapes – the distributions in each group need to have a similar shape

RUN TEST

Run test is a statistical test used to determine of the data obtained from a sample is ramdom. That is why it is called Run Test for Randomness. Randomness of the data is determined based on the number and nauture of runs present in the data of interest.

MEDIAN TEST FOR TWO INDEPENDENT SAMPLES

The median test is a statistical procedure for testing whether two independent populations differ in their measure of central tendency or location. That is median test enables us determine, whether it is likely that two independent or unrelated samples not necessarily of the same size have been drawn from two populations with equal medians

MODULE IV

FACTORIAL EXPERIMENT

In statistics, a factorial experiment is an experiment whose design consists of two or more factors, each with discrete possible values or “levels”, and whose experimental units take on all possible combinations of these levels across all such factors.

FACTORIAL DESIGN

Factorial Designs are used to examine multiple independent variables while other studies have singular independent or dependent variables.

ADVANTAGES

Factorial designs are extremely useful to psychologists and field scientists as a preliminary study, allowing them to judge whether there is a link between variables, whilst reducing the possibility of experimental error and confounding variables.

The factorial design, as well as simplifying the process and making research cheaper, allows many levels of analysis. As well as highlighting the relationships between variables, it also allows the effects of manipulating a single variable to be isolated and analyzed singly.

Difference between single factor Experimental Design and Factorial Designs

Factorial design involves having more than one independent variable, or factor, in a study. **Factorial designs** allow researchers to look at how multiple factors affect a dependent variable, both independently and together. **Factorial design** studies are named for the number of levels of the factors.

Often, we wish to investigate the effect of a **factor** (independent variable) on a response (dependent variable). We then carry out an **experiment** where the levels of the **factor** are varied. Such **experiments** are known as **single-factor experiment**.

2^2 FACTORIAL DESIGN

- One common type of experiment is known as a 2×2 factorial design. In this type of study, there are two factors (or independent variables) and each factor has two levels.

ANALYSIS OF 2^2 DESIGN

Here is the regression model statement for a simple **2 x 2 Factorial Design**. In this design, we have one factor for time in instruction (1 hour/week versus 4 hours/week) and one factor for setting (in-class or pull-out). The model uses a **dummy variable** (represented by a `Z`) for each factor. In two-way factorial designs like this, we have two main effects and one interaction. In this model, the main effects are the statistics associated with the beta values that are adjacent to the `Z`-variables. The interaction effect is the statistic associated with `b3` (i.e., the `t`-value for this coefficient) because it is adjacent in the formula to the multiplication of (i.e., interaction of) the dummy-coded `Z` variables for the two factors. Because there are two dummy-coded variables, each having two values, you can write out 2 x 2 = 4 separate equations from this one general model. You might want to see if you can write out the equations for the four cells. Then, look at some of the differences between the groups

Yates method of computing factorial effect total

Yates developed a special computational rule which enables us to compute the totals. The following are the steps:

Step 1. In the first column, we write the treatment combinations. The treatment combination are 1, a, b, ab.

Step 2. Against each treatment combinations, write the corresponding total yields from all the replications.

Step 3. The entries in the third column is split into levels. The first half is obtained by writing down in order, the pairwise sums of the values in column 2 and the second half is obtained by writing in the same order the pairwise differences of the values in the second column. Remember that the first member is to be subtracted from the second member of a pair.

Step 4. To complete the 4 ^ (th) column, the whole procedure in step 3 is repeated on column 3.

Table 4.2 Yates method for a 2^2 experiment

Treatment	*Total Yield*	(3)	(4)	*Effect Total*
1	[1]	[1] + [a]	[1] + [a] + [b] + [ab]	*Grand total*
a	[a]	[b] + [ab]	[ab] − [b] + [a] − [1]	[A]
b	[b]	[a] − [1]	[ab] + [b] − [1] − [a]	[B]
ab	[ab]	[ab] − [b]	[ab] − [b] − [a] + [1]	[AB]

2^3 Factorial Design

In principle, factorial designs can include any number of independent variables with any number of levels. For example, an experiment could include the type of psychotherapy (cognitive vs. behavioral), the length of the psy chotherapy (2 weeks vs. 2 months), and the gender of the psychotherapist (female vs. male). This would be a 23 factorial design and would have eight conditions.

MODULE V

SCORES AND SCALES OF MEASUREMENT

The objective evaluation of psychological tests involves primarily the determination of the reliability and validity at a high level as possible.

RELIABILITY OF TEST SCOR

Types of Reliability

1. Test/Retest Reliability

"In this method reliability coefficient is simply the correlation between the scores obtained by the same person on two administrations of the same test".

Test/retest is the more conservative method to estimate reliability. Simply put, the idea behind test/retest is that you should get the same score on test 1 as you do on test 2. The three main components to this method are as follows:

- implement your measurement instrument at two separate times for each subject;
- compute the correlation between the two separate measurements; and
- assume there is no change in the underlying condition (or trait you are trying to measure) between test 1 and test 2.

Factor Effecting Test/Retest Reliability

- Interval
- Experience
- Errors due to conditions of test takers
- Errors due to uncontrolled test conditions

2. Parallel or Alternative form of Reliability

In the parallel form procedure, two tests that are equivalent, in the sense that they contain the same kind of items of equal difficulty level but not the same items re administered to the same examiner.

3. Internal Consistency Methods

Internal consistency estimates reliability by grouping questions in a questionnaire that measure the same concept. For example, you could write two sets of three questions that measure the same concept (say class participation) and after collecting the responses, run a correlation between those two groups of three questions to determine if your instrument is reliably measuring that concept

I. Split-Half Reliability

Step 1: Divide the test into equivalent halves.

Step 2: Compute a Pearson r between scores on the two halves of the test.

Step 3: Adjust the half-test reliability using the Spear-man-Brown formula

II. Kuder-Richardson Reliability or Coefficient Alpha

The appropriate use of this method requires that all items in the test should be psychologically ***homogeneous*** that is every item should measure the same factor or a combination of factors in the same proportion every other item does.

The Kuder-Richardson reliability or coefficient alpha is relatively simple to do, being based on one administration of the test. It assesses inter-item consistency of test by looking at two error measures:

- Adequacy of content sampling
- Heterogeneity of domain being sampled

It assumes reliable tests contain more variance and are thus more discriminating. Higher heterogeneity leads to lower inter-item consistency. For right/wrong scores that are non-dichotomous items:

Formula No 20

Its uses where the problem of difficulty level present.

$$R = k / k - 1[1 - \Sigma pi(1 - pind)/\sigma 2)]$$

Where *K* is number of items, ***pi*** is item variance, ***pind*** is test variance.

- Pi= Probability of score.
- Pind= Proportion of person.
- K=Total number of items.
- σ/SD=Standard deviation of the total score of test.

Formula No 21

Its uses where only two options are available.

$$R = k/k - 1[1 - mean(k - mean)/\sigma 2]$$

When three or more options are available in test then uses this formula as under.

$$R = k / k - 1[1 - \Sigma(Si2/St2)]$$

Equivalence of results (parallel form)

level. Power tests tend to be used more at the graduate, professional or managerial level. Although, this is not always the case, as speed tests do give an accurate indication of performance in power tests. In other words, if you do well in speed tests then you will do well in power tests as well.

These speed and power definitions apply only to maximum performance tests like aptitude and ability tests and not to personality tests.

Factors Effecting/Influencing Reliability

- Length of the test
- Characteristics of the population*(If the population is more hatro-genious the reliability of of the test will reliable than homo-genious).*
- Characteristics of the test itself
- Method itself
- Range of age
- Time interval

VALIDITY

The concept of validity was formulated by Kelly ,who stated that a test is valid if it measures what it claims to measure

TYPES OF VALIDITY

. Validity refers to a test's ability to measure what it is supposed to measure. Learn the definition and importance of validity in psychology and explore the different types of validity, including construct, content, and criterion-related validity.

Construct Validity

A **construct** is an attribute, skill, or ability that is based on established theories and exists in the human brain. Intelligence, anxiety, and depression are all examples of constructs. **Construct validity** is the degree to which a test measures the construct that it is supposed to measure.

Content Validity

. A measurement has **content validity** when its items cover all aspects of the construct being measured. In other words, content validity lets us know if the items on the BAI adequately cover all areas of anxiety.

Criterion-Related Validity

It refers ti the degree to which a measurement can be accurately predict specific criterion variables. Concurrent and predictive validity are the two types of criterion related validity.

FACE VALIDITY

It is determined by a review of the items.

SCORES

- In statistics, the score (or informant) is the gradient of the log-likelihood function with respect to the parameter vector. Evaluated at a particular point of the parameter vector, the score indicates the steepness of the log-likelihood function and thereby the sensitivity to infinitesimal changes to the parameter values.

TYPES

- **Standard scores**
- **T scores**
- **C scores**
- **Stanine scores**

SCALES OF MEASUREMENT

There are **four scales of measurement** in statistics which are nominal scale, ordinal scale, interval scale, and ratio scale. Scales of measurement are defined as the ways to collect and analyze data.

1.Ordinal Scale of Measurement

The ordinal scale of measurement groups the data into order or rank. It contains the property of nominal scale as well, which is to classify data variables into specific labels. And in addition to that, it organizes data into groups though it does not have any numerical value.

2.Interval Scale of Measurement

The interval scale of measurement includes those values that can be measured in a specific interval, for example, time, temperature, etc. It shows the order of variables with a meaning proportion or difference between them.

3.Ratio Scale of Measurement

The ratio scale is the most comprehensive scale among others. It includes the properties of all the above three scales of measurement. The unique feature of the ratio scale of measurement is that it considers the absolute value of zero, which was not the case in the interval scale. When we measure the height of the people, 0 inches or 0 cm means that the person does not exist. On the interval scale, there are values possible on both sides of 0,

RATING SCALE

A rating scale is a popular closed-ended question type where you can assign different weights to each answer option.

Types of Rating Scales

Rating scales come in different shapes and sizes to achieve your unique research goals. Let’s look at the leading types of rating scales for questionnaires.

1. Graphic Scale

In these types of rating scale survey questions, the survey participants are required to respond to graphics/images instead of numbers.

2.**Descriptive rating scale**

. A **descriptive scale** provides an evaluator with a description of the defining characteristics for each rating point for evaluating performance in a constant and standardized way.

3. **Likert scales**

It was developed to measure the attitude, values and feelings of people.

QUESTIONNAIRE

It a set of questions for obtaining statistically useful or personal information from individuals

Types of questionnaire

- **Open format questions:** these questions provide an opportunity to the respondents to express their opinion that provide an opportunity to the respondents to express their opinion and answers in their own way

- **Closed format questions**

These questions offer respondents , a number of alternative replies from which the subject first choose the one that most likely matches the appropriate answer.

GUIDELINES FOR DRAFTING A QUESTIONNAIRE

1. The questionnaire should be developed in accordance with the dy objective

2 The questionnaire should begin with introduction for the respondents to provide responses.

3. The drafting of the questionnaire should be concise, precise and brief, as the lengthy questionnaire may lead to boredom among re spondents.

4. The language of the questionnaire should be known to the respon dent

5. Questions outside the respondent experience should not be asked.

6. In asking questions, too much reliance should not be placed on the respondent's memory.

7. Questions that are likely to leave to bias in the respondents should be avoided.

8. Questions should be very clear and simple. Avoid professional jar gons.

9. As far as possible, open ended questions should be avoided.

10. Avoid questions with difficult concepts, which are not easily under standable for respondence.