MEASUREMENT

Measurement means the assignments of numbers to objects or persons to represent quantities of their attributes. The assignment of numbers is done according to some rule. The attribute of person could include his income, preference, religion, social class, attitude etc. Similarly we measure a product's speed, colour, size, flavour etc. It is the characteristic of the buyer or the product which is measured and not the person or product itself. There are four types of scales used in marketing research to measure attitude towards a particular product/service. These are as follows:

1. Nominal Scale
2. Ordinal Scale
3. Interval Scale
4. Ratio Scale

1. **Nominal Scale:** In this type of measurement numbers are used to label persons, objects or events. For example, the variable sex may be categorized as male or female. One may assign a number 1 to male and 0 to female. It only helps us to identify that whenever number 1 is used we are talking about males and 0 in case of females. Similarly if the units in the population are to be classified according to religion viz. Hindu, Muslin, Sikh and Christian; one may label Hindu as 101, Muslim as 102, Sikh as 103 and Christian as 104. The numbers, here, have no meaning in the sense that the category which is assigned a higher number is in no way more important (or bigger) than the category which is assigned a lower number.

   The classification to identify objects, events and person is also done on the basis of the letters of English alphabets. Using the example mentioned in the preceding paragraph one could have labeled males as A and females as B. Similar procedure may be used for another type of classification. However, the classification should be done in such a way that groups are mutually exclusive and collectively exhaustive.

   The only mathematical operation performed on nominally measured data is the count in each category. Numbers assigned to represent categories (e.g. 1 for male and 0 for female) cannot be added, subtracted, multiplied or divided. We can only say (if sample comprises of 100 respondents) that there are 70 males and 30 females. Also we can say that the sample comprises of say 40% Hindus, 20% Sikhs, 30% Muslims and 10% Christians. The statistical procedures applicable for nominal scale measurement are Mode and Chi-Square.

2. **Ordinal Scale**: A significant amount of consumer oriented research relies on ordinal measurement. Here numbers, letters or any other symbols are used to rank items. Ordinal scale tells us whether an object or event has more or less of a characteristic than some other object or event. Unfortunately this scale does not indicate how much more and how much less we have of the characteristics the objects or events process. For example, we may be examining the marks in Marketing for 60 students in a class. Assume that the highest score in the class is 92, the second highest 63 and the third highest 60. We rank the person getting 92 marks as 1, 63 marks as 2 and 60 marks as 3. However the difference between the marks of first and second rank is not the same as the difference in the marks of students obtaining second and third rank.

   The common mathematical operations like addition, subtraction, multiplication and division cannot be used with ranked data. However, statistical procedure based on interpretation of "greater than" or “less than” are permissible: The statistical methods applicable with ordinal data are percentiles, median and rank order correlation.

   The ordinal scale measurement is of higher level than the nominal scale measurement i.e. to say the ordinal scale data can also be converted into nominal scale data and thus will process all the

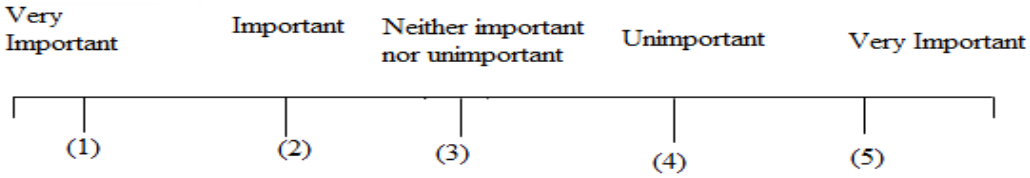
properties of nominal scale data. As an example assume that 107 consumers are divided according to their income and the classification is as given below:

Monthly Income (Rs.)	**No. of Consumers (Rs.)**
Less than 5000	20
5001 - 8000	30
8001 - 11000	25
11001 - 13000	20
13001 and above	12
TOTAL	107

A consumer having an income of Rs. 7500 will be ranked higher than the one having income of less than Rs. 5000 (Ordinal scale data). However, the sample of 107 consumers can be classified into 5 income categories to be labeled as A for less than Rs.5000, B for 5001-8000, C for 8001-11000, D for 11001-13000 and E for 13001 and above (nominal scale data). A consumer having a monthly income of Rs.12000 will belong to category D.

3. **Interval Scale:** Interval scale responses are more powerful than ordinal scale responses. They not only have the properties of ordinal and nominal scale measurement but also, the strength of the equality of differences between ranks. For example, the consumers may be asked the following question.

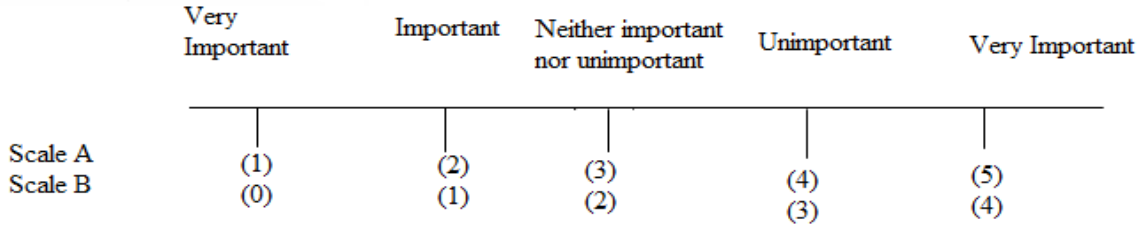
How important is price to you while buying furniture?



One may note that very important is assigned a number (1), important as (2) and so on and lastly very unimportant is assigned a number (5). What is assumed here is that the respondent is able to reply on a continuum scale and the difference between any two responses can be meaningfully interpreted,
The general mathematical form of interval scale is given by the equation.

$Y = a + bX$

Here we are considering an arbitrary zero point or starting point and therefore the division of two responses has no meaningful interpretation. Instead of giving number 1 to very important and 5 to very unimportant in the above example, if the numbering starts from 0 to 4 the picture would look like as shown below in Scales A and B.



We may assume the first respondent ticks unimportant and the second respondent ticks important while answering the question. Therefore the ratio of the scale values in the first case is 4/2=2 and if we use Scale B, the ratio is 2/1=2. Although the differences in the both cases are same and equal two, the ratios are different in both cases and have no meaningful interpretation. The statistical procedures applicable in this case are range, mean, standard deviation and product moment correlation. However, all the statistical procedures applicable for ordinal and nominal scale measurements can also be used in this case.

4. **Ratio Scale:** Ratio scale measurements are the most powerful measurement discussed so far as they poses all the properties of the measurement scales which we have discussed. Ratios of the numbers on these scales have meaningful interpretation. They possess an unambiguous starting point. The mathematical form of the measurement is written as

   Y=bX

   The examples of ratio scale measurement are Income, Distance travelled from home to workplace, Height, Weight, Density etc. The statistical methods applicable for this type of measurement are geometric mean, harmonic mean, coefficient of variation etc. Also all the statistical procedures described for the remaining type of measurements are also applicable under this case.

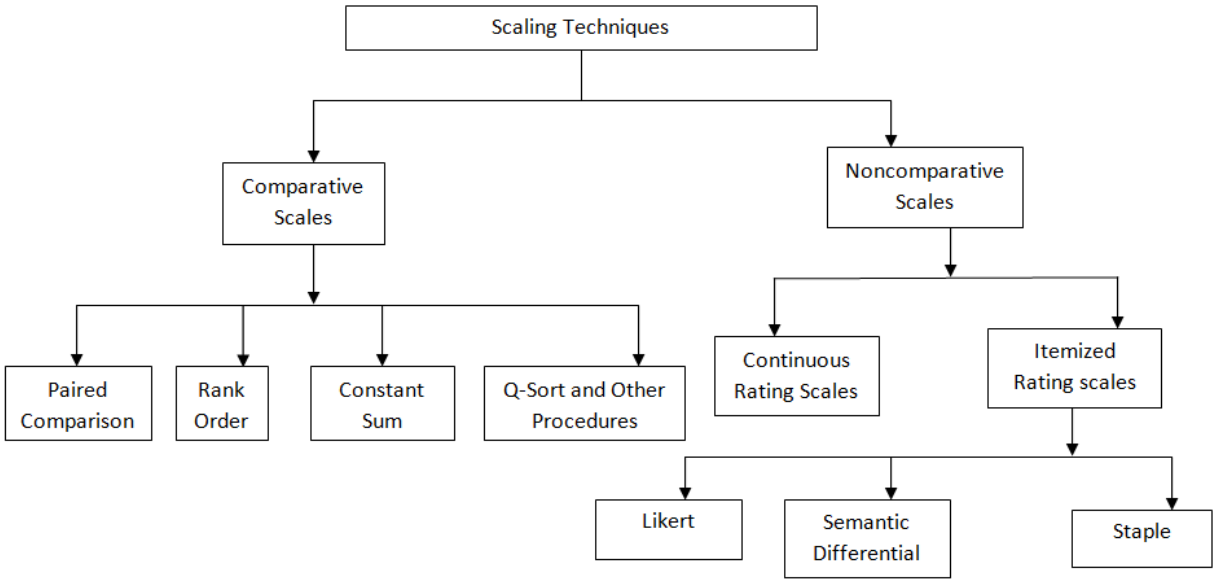
   As mentioned in the preceding paragraphs, the methods of analysis for data depends upon the type of measurements used to measure it. The table below gives the permissible statistics to be used under different types of measurement.

Table 1: Scales Of Measurement Scale	**Permissible Statistics**
Nominal	Mode
Ordinal	Median
	Percentile
	Rank Order Correlation
Interval	Mean
	Average deviation
	Standard deviation
Ratio	Geometric Mean
	Harmonic mean

Scaling Techniques:

The scaling techniques commonly employed in marketing research can be classified into comparative and noncomparative scales. ***Comparative scales*** involve the direct comparison of stimulus objects. Comparative scale data can be interpreted in relative terms and have only ordinal or rank order properties. For this reason it is also referred to as nonmetric scaling. The major benefit of comparative scaling is that small differences between stimulus objects can be detected. As they compare the stimulus objects, respondents are forced to choose between them. Comparative scales are easily understood and can be applied easily. Other advantages of these scales are that they involve fewer theoretical assumptions, and they also tend to reduce halo or carryover effects from one judgment to other. The major disadvantages of comparative scales include the ordinal nature of the data and the inability to generalize beyond the stimulus objects scaled.

In ***noncomparative scales,*** also referred to as monadic or metric scale, each object is scaled independently of the others in the stimulus set. The resulting data are generally assumed to be interval or ratio scaled. For example, respondents may be asked to evaluate Coke on a 1-to-6 preference scale (1 = not at all preferred, 6 = greatly preferred). Noncomparative scales can be continuous rating or itemized rating scales.



Paired Comparison:

The Respondent is presented with two objects at a time and is required to indicate a preference for one of the two according to some states criterion. Here, each of the *n* stimuli is compared pair-wise with every other stimulus. The method yields ordinal scaled data, For example, brand A is better than brand B, or, brand A is cleaner than brand B and so on. It is often applied in cases where the objects are physical products. The ordinal data can be readily converted into interval- scaled data.
An essential assumption on which the validity of the paired comparison scale is based is that of transitivity of preference- if A>B and B>C then A>C. Another limitation of the paired comparison is that it is useful only when the number of brands or stimuli being compared is limited. If the number of brands is large, as may happen in real life situations, the pair wise comparison becomes unwieldy and mechanical. Moreover, in the marketplace, consumers have a clear preference for one or few out of large number of brands; they don't usually make a paired wise comparison.

Rank Order:

Among ranking scales, the rank order scales are the most commonly used comparative scales. There are varieties of ranking, or ordering, methods. Some of these are listed here:

- A full rank order in which all n objects may be ranked in increasing or decreasing order with respective some property of the object.

- Selecting any k out of n objects and ranking them. For example, from a list of 8 attributes of men's shirts, the respondent may be asked 5 most important attributes. The next step may be to ask the respondent to rank these five in the order of their relative importance.
- The paired comparison method, which asks the respondent to compare or rank two objects at a time out of n, each object being ranked against every other object in turn. There are, therefore $n(n-1)/2$ such rankings in all.

Constant Sum:
They are essential comparative scales that provide information not only about the direction of difference between two successive categories but also the degree of difference. Such a scale operates by asking the respondent to divide a fixed number of points, usually 100 or 10, between the number of items to be rated, in a manner that point assigned to each item should be indicative of the importance of each item relative to the other items. The rating given to all items should, of course, add up to 100(or 10).

This is very popular scale because of its simplicity coupled with significant amount of information it provides. Its limitation, however, is that it cannot be meaningfully applied to a comparison of more than a maximum of five items. With a large number of items the response becomes mechanical and the respondent's concentration is more on ensuring that the totals add up to 100 than on providing item ratings that are a true reflection of the perception of the item being rated.

Q-Sort:
Certain comparative scales operate by permitting a tie between the items being rated. The scale operates on the assumption of equal intervals between categories, which are typically lower in number than the stimuli. The stimuli, or items, may be assigned to the same or different categories as per the respondent's perception. There are two variants of this kind of scale.

- In one variant, the numbers of items to be assigned to a category are fixed in advance.
- In the second variant, the respondent's perception may help assign the stimulus to any category. The assumption in this case is that the distribution of stimuli in each category follows the normal distribution.

Continuous and Itemized Rating Scale:
The itemized scale results in a one-to-one correspondence between the position of the object as perceived by the respondents and the number assigned to that category the responses are thus sorted into predetermined categories.
A continuous scale is expressed as a line that runs between the two extremes of the scale and only these two extremes are labeled such as 5 and 1, in the preceding scale. The categories in between are not specified. This has the advantage of getting more accurate and detail information from the respondents, who may put a mark anywhere on the scale to indicate an exact perception. Once these markings have been obtained, the researcher divides the line into as many categories as desired, and assigns scores to the respondents ratings depending on the categories into which the ratings fall. The scores are treated as interval data. The advantage of the ease of the construction is offset by the limitation that the comparison of the responses from two respondents and the interpretation of such responses become very difficult and subjective.

Likert:

This is an ordinal scale also called the summated scale, since the individual scores of the respondent on the large numbers of items are added to form the overall attitude score of the respondent. Respondents are then grouped into various categories, indication the strength of their opinion about an object. The final scale is thus unidimensional, assuming that each statement reflect some part, or dimension, of the overall attitude. The original Likert scale is 5 point scale, where one stands for Total Disagree and 5 Totally Agree.

Semantic differential scale:

This is the set of scale that rates the object under study on a number of itemized rating scales bounded by the set of bi polar adjectives. This scale is often used for a profile analysis of companies, products, institutions and the brands. The classical semantic differential scale is the seven point scale, with the neutral middle position. It measures respondent perception of one or more stimuli, using adjectives with a opposing meanings to define the two end points.

Staple Scale:

This is the unipolar scale with ten categories without a neutral point. It is similar to semantic differential scale, which uses adjectives at one end of the scale to measure the stimulus on various dimensions. It is possible to use it even when the questionnaire is being administered through non personal modes of interview such as Telephonic interview.