

Describe the Matrix representation of transitive relation?

We know that

- 1) If a relation is reflexive then its matrix representation has unit diagonal, to say as follow

1	0	1
1	1	0
0	0	1

- 2) If a relation is symmetric then its matrix representation is also symmetric about the diagonal, to say as follows;

1	0	1
0	1	1
1	1	1

Here you can see that matrix has same upper and lower triangular entries.

Now question arise what kind of special structure or pattern we obtain in the case of transitive relation? Well!! It is not possible to find such kind of specialty in the pattern or structure of matrix representation of transitive relation. But in this case there should preserve (we get) a shortest "path", means to say if we have (a,b) and (b,c) then definitely there exist (a,c). In other words if there are the "PATHS" from $a \rightarrow b$ & $a \rightarrow c$ then for the transitive relation there must exist $a \rightarrow c$.

In matrix representation if we have 1,1 entries corresponding to (a,b) and (b,c) respectively then there must exist (we should "search" for) entry '1' at (a,c)

e.g:

For a set say $A = \{a,b,c\}$, we have a relation say

$$R_1 = \{(a,a), (a,b), (a,c), (b,c), (c,c)\}$$

	A	B	C
A	1	1	1
B	0	0	1
C	0	0	1

Here you can verify all the criteria of transitivity as discussed above.

What is difference between percent and percentage?

Percentage is a way of expressing a number as a fraction of 100 (per cent meaning "per hundred"). It is often denoted using the percent sign, "%". For example, 45% (read as "forty-five percent") is equal to $45 / 100$, or 0.45. Percentages are used to express how large one quantity is relative to another quantity. The first quantity usually represents a part of, or a change in, the second quantity, which should be greater than zero. For example, an increase of \$ 0.15 on a price of \$ 2.50 is an increase by a fraction of $0.15 / 2.50 = 0.06$. Expressed as a percentage, this is therefore a 6% increase.

Define decimal fraction and common fraction.

A decimal fraction is a fraction where the denominator is a power of ten. e.g., $8/10$, $83/100$, $83/1000$, and $8/10000$ are expressed as: 0.8, 0.83, 0.083, and 0.0008. A common fraction is a fraction in which numerator and denominator are both integers, as opposed to fractions. For example $2/5$ is a common fraction

Why we use round function?

The ROUND function is used to round a numeric field to the number of decimals specified. The Round function returns a number rounded to a specified number of decimal places. However, the Round function behaves a little peculiar, so before using this function, please read the following: The Round function utilizes round-to-even logic. If the expression that you are rounding ends with a 5, the Round function will round the expression so that the last digit is an even number. For example: Round (12.55, 1) would return 12.6 (rounds up) Round (12.65, 1) would return 12.6 (rounds down) Round (12.75, 1) would return 12.8 (rounds up)

What is the difference between a sequence and a series?

A sequence is a list of numbers. The order in which the numbers are listed is important, as 1, 2, 3, 4, 5... is one sequence, and 2, 1, 4, 3, 6, 5, ... is an entirely different sequence. A series is a sum of numbers. For example, $1 + 1/2 + 1/4 + 1/8 + 1/16 + \dots$ is an example of a series. A series is composed of a sequence of terms that are added up. The order in which the terms appear is sometimes important; there are certain kinds of series in which any rearrangement of the terms will not affect its sum (these are called "absolutely convergent"). There are others in which different arrangements of the terms will cause the sum of the series to change. Sequences and series are often confused because they are closely related to each other. But when we say "sequence," we are not concerned with the sum of the values of the terms, whereas in a series, we are interested in such a sum. For example: 1, $1/2$, $1/3$, $1/4$, $1/5$, $1/6, \dots$ is a sequence, and its n (th) term will be $1/n$

Define arithmetic operators.

The arithmetic operators are • Addition • Subtraction • Multiplication • Division • Exponents

How does form relations (R1, R2, R3, R4...) on Cartesian product?

The Cartesian product of two sets X (for example the points on an x-axis) and Y (for example the points on a y-axis), denoted $X \times Y$, is the set of all possible ordered pairs whose first component is a member of X and whose second component is a member of Y (e.g. the whole of the x-y plane): $R = X \times Y = \{(x, y) / x \in X \text{ and } y \in Y\}$ then every possible subset of R is a relation denoted by R1, R2, R3.... For Example: $X = \{1, 2\}$ and $Y = \{4, 5\}$ $R = X \times Y = \{(1, 4), (1, 5), (2, 4), (2, 5)\}$ $R1 = \{(1, 4)\}$ $R2 = \{(1, 5)\}$ $R3 = \{(2, 4)\}$ $R4 = \{(2, 5)\}$ $R5 = \{(1, 4), (1, 5)\}$ $R6 = \{(1, 4), (2, 4)\}$ $R7 = \{(1, 4), (2, 5)\}$ $R8 = \{(1, 5), (2, 4)\}$ $R9 = \{(1, 5), (2, 5)\}$ $R10 = \{(2, 4), (2, 5)\}$ $R11 = \{(1, 4), (1, 5), (2, 4)\}$ $R12 = \{(1, 4), (1, 5), (2, 5)\}$ $R13 = \{(1, 4), (2, 4), (2, 5)\}$ $R14 = \{(1, 5), (2, 4), (2, 5)\}$ $R = R15 = \{(1, 4), (1, 5), (2, 4), (2, 5)\}$ $R16 = \{ \}$.

Explain Venn diagram.

Venn diagram is a pictorial representation of sets. Venn diagram can sometime be used to determine whether or not an argument is valid. Real life problems can easily be illustrate through Venn diagram if you first convert them into set form and then in Venn diagram form. Venn diagram enables students to organize similarities and differences visually or graphically. A Venn diagram is an illustration of the relationships between and among sets, groups of objects that share something in common

What is a function?

A function say 'f' is a rule or machine from a set A to the set B if for every element say a of A, there exist a unique element say b of set B such that $b=f(a)$ Where b is the image of a under f, and a is the pre-image. Note it that set A is called the domain of f and Y is called the co domain of f. As we know that function is a rule or machine in which we put an input, and we get an output .Like that a juicer machine. We take some apples (here apples are input) and we apply a rule or a function of juicer machine on it, then we get the output in the form of juice

What is domain and co -domain.

Domain means "the set of all x-coordinates in a relation". It is very simple, Let we take a function say f from the set X to set Y. Then domain means a set which contain all the elements of the set X. And co domain means a set which contain all the elements of the set Y. For example: Let we define a function "f" from the set $X= \{a, b, c, d\}$ to $Y= \{1, 2, 3, 4\}$. such that $f(a)=1, f(b)=2, f(c)=3, f(d)=1$ Here the domain set is $\{a, b, c, d\}$ And the co-domain set is $\{1,2,3,4\}$ Where as the image set is $\{1,2,3\}$.Because $f(a)=1$ as 1 is the image of a under the rule 'f'. $f(b)=2$ as 2 is the image of b under the rule 'f'. $f(c)=3$ as 3 is the image of c under the rule 'f'. $f(d)=1$ as 1 is the image of d under the rule 'f'. Because "image set contains only those elements which are the images of elements found in set X". Note it that here f is one -one but not onto, because there is one element '4' left which is the image of nothing element under the rule 'f'

Antisymmetric relation

Antisymmetric: A relation R on a set A is said to be antisymmetric if $(b, a) \in R$ and $(a, b) \in R$ then $a=b$ for all a, b A. Or a relation is antisymmetric if and only if there are no pairs of distinct elements a and b with a related to b and b related to a. Be careful student, there is a condition if first statement holds then second must be held. i.e. If $(b, a) \in R$ and $(a, b) \in R$ then $a=b$ Or you can say that if any order pair holds first condition but not second then it is not antisymmetric otherwise it is antisymmetric. let $A=\{1,2,3,4\}$ and a given relation is $R=\{(1,1)(1,2)(1,3)(1,4)(2,2)(2,3)(2,4)(3,3)(3,4)(4,4)\}$ then R is Antisymmetric. Since $(1, 2)$ belongs to R but $(2, 1)$ not belongs to R. First statement is not hold. Similarly other pairs are not hold first condition. So it is antisymmetric.

How we calculate percentage on excel sheet?

For percentage follow the following rules 1. Select an empty cell. 2. type = sign 3. enter value 4. type % 5. Press enter. For example =12% 0.12

What is arithmetic mean?

Arithmetic mean is simple averages of numbers that you have. e.g if you 4 numbers as 2,3,5,1 then arithmetic mean of these number is $2+3+5+1$ divided by 4. so arithmetic mean for above numbers is $11/4=2.75$ The arithmetic mean of a set of values is the quantity commonly called "the" mean or the average.

What is frequency distribution?

A frequency distribution shows the number of observations falling into each of several ranges of values. Frequency distributions are portrayed as frequency tables, histograms, or polygons. Frequency distributions can show either the actual number of observations falling in each range or the percentage of observations. In the latter instance, the distribution is called a relative frequency distribution.

What is purpose of frequency distribution?

The purpose of a frequency distribution is to summarize and organize a set of data. Presenting data in a frequency distribution makes inspection of the data set much more manageable than presenting the entire set of raw data. A frequency distribution can be considered a type of descriptive statistic.

What is cumulative frequency?

A distribution that indicates the category or score value and the cumulative frequency (cum f) or proportion/percentage (cum p/cum %) of the total number of cases below the upper real limit of the associated category or score value. Cumulative distributions are particularly helpful when determining Percentile Ranks and Percentile Points.

What types of frequency distribution table are?

In the simplest form, the table consists of two columns, one for the score value (X) and a second indicating the number of observations for the score value (f). Note: $\sum f = N$, where N is total number of observations. The X values should be: 1. Continuous 2. Descending To find the sum of the entire set of scores, you can multiply the score value, X, by the number of times the score value was observed, f, and sum these products.

What are the measures of central tendency?

We saw that there are several ways to define central tendency. This section defines the three most common measures of central tendency: the mean, the median, and the mode

What is range?

Range is the difference between the highest and lowest data element

How do the various measures of central tendency compare with each other?

The three most commonly-used measures of central tendency are the following. Mean The sum of the values divided by the number of values--often called the "average." • Add all of the values together. • Divide by the number of values to obtain the mean. Example: The mean of 7, 12, 24, 20, 19 is $(7 + 12 + 24 + 20 + 19) / 5 = 16.4$. Median The value which divides the values into two equal halves, with half of the values being lower than the median and half higher than the median. • Sort the values into ascending order. • If

you have an odd number of values, the median is the middle value. • If you have an even number of values, the median is the arithmetic mean (see above) of the two middle values. Example: The median of the same five numbers (7, 12, 24, 20, 19) is 19. Mode The most frequently-occurring value (or values). • Calculate the frequencies for all of the values in the data. • The mode is the value (or values) with the highest frequency. Example: For individuals having the following ages -- 18, 18, 19, 20, 20, 20, 21, and 23, the mode is 20. Check your understanding of these concepts by calculating the mean, median, and mode of the following three sets of numbers.

What is Variance?

Variance is the third method of measuring dispersion. Compare the two variance formulae with their corresponding standard deviation formulae, and we see that variance is just the square of the standard deviation.

What is mean deviation?

The mean deviation (also called the mean absolute deviation) is the mean of the absolute deviations of a set of data about the data's mean.

What is quartile deviation?

It is based on the lower quartile Q1 and the upper quartile Q3. The difference $Q3 - Q1$ is called the inter quartile range. The difference $Q3 - Q1$ divided by 2 is called semi-inter-quartile range or the quartile deviation. Thus Quartile Deviation (Q.D) = $(Q3 - Q1) / 2$. The quartile deviation is a slightly better measure of absolute dispersion than the range. But it ignores the observation on the tails. If we take difference samples from a population and calculate their quartile deviations, their values are quite likely to be sufficiently different. This is called sampling fluctuation. It is not a popular measure of dispersion. The quartile deviation calculated from the sample data does not help us to draw any conclusion (inference) about the quartile deviation in the population.

What is probability?

An experiment is a situation involving chance or probability that leads to results called outcomes. $P(A) = \frac{\text{The Number Of Ways Event A Can Occur}}{\text{The Total Number Of Possible Outcomes}}$ The probability of event A is the number of ways event A can occur divided by the total number of possible outcomes. Let's take a look at a slight modification of the problem from the top of the page. Example: A spinner has 4 equal sectors colored yellow, blue, green and red. After spinning the spinner, what is the probability of landing on each color? Outcomes: The possible outcomes of this experiment are yellow, blue, green, and red. Probabilities: $P(\text{yellow}) = \frac{\text{number of ways to land on yellow}}{\text{total number of colors}} = \frac{1}{4}$ $P(\text{blue}) = \frac{\text{number of ways to land on blue}}{\text{total number of colors}} = \frac{1}{4}$ $P(\text{green}) = \frac{\text{number of ways to land on green}}{\text{total number of colors}} = \frac{1}{4}$ $P(\text{red}) = \frac{\text{number of ways to land on red}}{\text{total number of colors}} = \frac{1}{4}$

A pair of dice is rolled. Let A denote the event “the sum shown is 5” and B the event “the two dice show the same number”. Find a). $P(A / B)$ b). $P(B / A)$ c). $P(A / B')$

$A = \{(1, 4), (2, 3), (3, 2), (4, 1)\}$ $B = \{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$ $B^c = \{(1, 2), (1, 3), (1, 4), \dots\}$ $A \cap B = \text{empty}$ $A \cap B^c = \{(1, 4), (2, 3), (3, 2), (4, 1)\}$ $P(A) = 4/36$, $P(B) = 6/36$, $P(B^c) = 30/36$. $P(A \cap B) = 0/36 = 0$ $P(A \cap B^c) = 4/36$ a) $P(A/B) = P(A \cap B)/P(B) = 0$ b) $P(B/A) = \text{undefined}$ c) $P(A/B^c) = 4/30 = 1/15$

What is average deviation?

The average of absolute deviations of the individual values from the median or from the mean is called average deviation.

What does measure of dispersion mean?

Measure of dispersion is a measurement of the spread or variability in a set of scores.

When does the matrix multiplication possible?

Matrix multiplication is only possible if the row matrix and the column matrix have the same number of elements.

What is meant by Discrete?

A type of data is discrete if there are only a finite number of values possible. Discrete data usually occurs in a case where there are only a certain number of values, or when we are counting something (using whole numbers). For example, 5 students, 10 trees etc.

Role of "Discrete Mathematics" in our practical life, what advantages will we get by learning it?

Discrete mathematics concerns processes that consist of a sequence of individual steps. This distinguishes it from calculus, which studies continuously changing processes. While the ideas of calculus were fundamental to the science and technology of the industrial revolution, the ideas of discrete mathematics underline the science and technology specific to the computer age. Logic and proof: An important goal of discrete mathematics is to develop students' ability to think abstractly. This requires that students learn to use logically valid forms of argument, to avoid common logical errors, to understand what it means to reason from definition, and to know how to use both direct and indirect argument to derive new results from those already known to be true. Induction and Recursion: An exciting development of recent years has been increased appreciation for the power and beauty of "recursive thinking": using the assumption that a given problem has been solved for smaller cases, to solve it for a given case. Such thinking often leads to recurrence relations, which can be "solved" by various techniques and to verifications of solutions by mathematical induction. Combinatorics: Combinatorics is the mathematics of counting and arranging objects. Skill in using combinatorial techniques is needed in almost every discipline where mathematics is applied, from economics to biology, to computer science, to chemistry, to business management. Algorithms and their analysis: The word algorithm was largely unknown three decades ago. Yet now it is one of the first words encountered in the study of computer science. To solve a problem on a computer, it is necessary to find an algorithm or step-by-step sequence of instructions for the computer to follow. Designing an algorithm requires an understanding of the mathematics underlying the problem to be solved. Determining whether or not an algorithm is correct requires a sophisticated use of

mathematical induction. Calculating the amount of time or memory space the algorithm will need requires knowledge of combinatorics, recurrence relations functions, and O-notation. Discrete Structures: Discrete mathematical structures are made of finite or countably infinite collections of objects that satisfy certain properties. Those are sets, Boolean algebras, functions, finite state automata, relations, graphs and trees. The concept of isomorphism is used to describe the state of affairs when two distinct structures are the same in their essentials and differ only in the labeling of the underlying objects. Applications and modeling: Mathematics topics are best understood when they are seen in a variety of contexts and used to solve problems in a broad range of applied situations. One of the profound lessons of mathematics is that the same mathematical model can be used to solve problems in situations that appear superficially to be totally dissimilar. So in the end I want to say that discrete mathematics has many uses not only in computer science but also in the other fields too.

What discrete objects are?

The objects that can be counted in whole numbers are called discrete objects

What is a proposition?

A sentence that is either true or false, but not both, is called a proposition. Or you can say that an unambiguously true or false assertion is called proposition for example $2+2=4$

What is statement?

A proposition is a statement that is either true or false.

When two compound propositions are logically equivalent?

When they have the same truth table values no matter what truth values their constituent propositions have.

How can we differentiate between Inclusive Or and Exclusive Or?

Inclusive OR A disjunction for which either or both statements may be true For example, the use of the word or in "A triangle can be defined as a polygon with three sides or as a polygon with three vertices" is inclusive. Either or both options can be true. **Exclusive OR** A disjunction for which either statement may be true but not both For example, the use of the word or in "This morning I can go to school or I can stay home" is exclusive. Either option may be true but not both.

What is the meaning of declarative sentence?

Declarative sentences are the sentences that state some fact. For Example: • Islamabad is the capital of Pakistan • $2+2=4$ • He is very rich

Difference between sentence and statement.

A sentence is a statement if it has a truth value otherwise this sentence is not a statement. By truth value I mean if I write a sentence "Lahore is capital of Punjab" Its truth value is "true" because yes Lahore is a capital of Punjab. So the above sentence is a statement. Now if I write a sentence "How are you" Then you cannot answer in yes or no. So this sentence is not a statement. Every statement is a sentence but converse is not true.

What is the truth table?

Truth table is a table which describes the truth values of a proposition. Or we can say that Truth table displays the complete behavior of a proposition. Therefore the purpose of truth table is to identify its truth values. A statement or a proposition in Discrete math can easily identify its truth value by the truth table. Truth tables are especially valuable in the determination of the truth values of propositions constructed from simpler propositions. The main steps while making a truth table are "first judge about the statement that how much symbols (or variables) it contain. If it has n symbols then total number of combinations = 2 raise to power n . These all the combinations give the truth value of the statement from where we can judge that either the truthness of a statement or proposition is true or false. In all the combinations you have to put values either "F" or "T" against the variables. But note it that no row can be repeated. For example "Ali is happy and healthy" we denote "Ali is happy" by p and "Ali is healthy" by q so the above statement contain two variables or symbols. The total no of combinations are = 2 raise to power 2 (as $n=2$) = 4 which tell us the truthness of a statement.

What is the De Morgan's law?

De Morgan law states "Negation of the conjunction of two statements is logically equivalent to the disjunction of their negation and Negation of the disjunction of two statements is logically equivalent to the conjunction of their negation". i.e. $\sim (p \wedge q) = \sim p \vee \sim q$ and $\sim (p \vee q) = \sim p \wedge \sim q$ For example: " The bus was late and Jim is waiting "(this is an example of conjunction of two statements) Now apply negation on this statement you will get through De Morgan's law " The bus was not late or Jim is not waiting" (this is the disjunction of negation of two statements). Now see both statements are logically equivalent. That's what De Morgan wants to say

What is Tautology?

A tautology is a statement form that is always true regardless of the truth values of the statement variables i.e. If you want to prove that $(p \vee q)$ is tautology ,you have to show that all values of statement $(p \vee q)$ are true regardless of the values of p and q . If all the values of the statement $(p \vee q)$ is not true then this statement is not tautology.

What is converse, Inverse and contrapositive

Inverse, converse and contrapositive are also statements which are made from simple conditional statement. The converse of the conditional statement $p \rightarrow q$ is $q \rightarrow p$.i.e. now conclusion become hypothesis and hypothesis become conclusion. The contrapositive of the conditional statement $p \rightarrow q$ is $\sim q \rightarrow \sim p$ i.e. Take the negation of conclusion and made it hypothesis and similarly take the negation of hypothesis and made it conclusion. The inverse of the conditional statement $p \rightarrow q$ is $\sim p \rightarrow \sim q$

What is p implies q ?

$p \rightarrow q$ means to "go from hypothesis to a conclusion" where p is a hypothesis and q is a conclusion. And note it that this statement is conditioned because the "truthness of statement p is conditioned on the truthness of statement q ". Now the truth value of $p \rightarrow q$ is false only when p is true and q is false otherwise it will always true e.g. consider an

implication "if you do your work on Sunday, I will give you ten rupees." Here p =you do your work on Sunday (is the hypothesis), q =I will give you ten rupees (the conclusion or promise). Now the truth value of $p \rightarrow q$ will be false only when the promise is broken i.e. you do your work on Sunday but you do not get ten rupees. In all other conditions the promise is not broken

Difference between the converse and the contrapositive of a conditional proposition

The converse of a conditional proposition merely reverses the roles of p and q , where p and q are propositions, whereas the contrapositive reverses the roles of p and q and negates each of them.

Is a conditional statement logically equivalent to its converse and contrapositive?

In general a conditional statement is not logically equivalent to its converse but it is logically equivalent to its contrapositive.

What is the difference between the converse and inverse?

The converse of a conditional statement is formed by interchanging the hypothesis and conclusion of the original statement. In other words, the parts of the sentence change places. The words "if" and "then" do not move. It is important to remember that the converse does NOT necessarily have the same truth value as the original conditional statement. Example: Conditional: "If the space shuttle was launched, then a cloud of smoke was seen." Converse: "If a cloud of smoke was seen, then the space shuttle was launched." The inverse of a conditional statement is formed by negating the hypothesis and negating the conclusion of the original statement. In other words, the word "not" is added to both parts of the sentence. It is important to remember that the inverse does NOT necessarily have the same truth value as the original conditional statement. Example: Conditional: "If you grew up in Alaska, then you have seen snow." Inverse: "If you did not grow up in Alaska, then you have not seen snow"

What is the meaning of implication?

Implication means "Condition of being implied". We put some condition on a statement to be true or false e.g. If you got A in class then you will go for a tour. We put a condition that for going on a tour you should get A.

What is the basic difference of Tautology and contradiction?

A compound statement that is always true, no matter what the truth values of the propositions that occur in it, is called a tautology, whereas a compound statement that is always false, no matter what the truth values of the propositions that occur in it, is called a contradiction.

Describe Idempotent Law.

Idempotent Law, The property of operations in mathematics and computer science which means that multiple applications of the operation do not change the result is called Idempotent

What is absurdity or contradiction?

A statement which is always false is called an absurdity.

What is argument?

An argument is a sequence of statements aimed at demonstrating the truth of an assertion. For example If x is a real number such that $x < -2$ or $x > 2$ then $x^2 > 4$, Therefore, if $x^2 < 4$, then $x > -2$ and $x < 2$.

Define “Critical rows”

In which all the premises are true in a truth table are called critical rows.

What is a valid and invalid argument?

As "an argument is a list of statements called premises (or assumptions or hypotheses) which is followed by a statement called the conclusion." A valid argument is one in which the premises entail (or imply) the conclusion. 1) It cannot have true premises and a false conclusion. 2) If its premises are true, its conclusion must be true. 3) If its conclusion is false, it must have at least one false premise. 4) All of the information in the conclusion is also in the premises. And an invalid argument is one in which the premises do not entail (or imply) the conclusion. It can have true premises and a false conclusion. Even if its premises are true, it may have a false conclusion. Even if its conclusion is false, it may have true premises. There is information in the conclusion that is not in the premises. To know them better, try to solve more and more examples and exercises.

Explain Valid Arguments.

When some statement is said on the basis of a set of other statements, meaning that this statement is derived from that set of statements, this is called an argument. The formal definition is “an argument is a list of statements called “premises” (or assumptions or hypotheses) which is followed by a statement called the “conclusion.” A valid argument is one in which the premises imply the conclusion. 1) It cannot have true premises and a false conclusion. 2) If its premises are true, its conclusion must be true. 3) If its conclusion is false, it must have at least one false premise. 4) All of the information in the conclusion is also in the premises.

How to check validity and invalidity of argument through diagram.

To check an argument is valid or not you can also use Venn diagram. We identify some sets from the premises. Then represent those sets in the form of diagram. If diagram satisfies the conclusion then it is a valid argument otherwise invalid e.g. if we have three premises S1: all my friends are musicians S2: John is my friend. S3: None of my neighbor is musicians. Conclusion John is not my neighbor. Now we have three sets Friends, Musicians, neighbors. Now you see from premises 1 and 2 that friends are subset of musicians'. From premises 3 see that neighbor is an individual set that is disjoint from set musicians. Now represent then in form of Venn diagram. Musicians neighbor Friends Now sees that john lies in set friends which is disjoint from set neighbors. So their intersection is empty. Which shows that john is not his neighbor. In that way you can check the validity of arguments.

A set is define a well define collection of distinct objects so why an empty set is called a set although it has no element?

Some time we have collection of zero objects and we call them empty sets e.g. set of natural numbers greater than 5 and less than 5. $A = \{x \text{ belongs to } \mathbb{N} / 5 < x < 5\}$ Now see this is a set which have collection of elements which are greater than 5 and less than 5 (from natural number)

Define Fraction.

Any number which can not represent as a whole number is called a fraction. For example $\frac{3}{4}$, $\frac{5}{3}$ etc

What is the difference between rational number and Irrational number?

Rational number: Any number which can represent in the form of $\frac{p}{q}$ where p, q belongs to set of integers and $q \neq 0$. As 7, $\frac{1}{2}$ etc Also a terminating, recurring decimal represents a rational number. Irrational number: Any number which can not represent in the form of $\frac{p}{q}$ where p, q belongs to set of integers and $q \neq 0$. For example π , $\sqrt{3}$ etc Also a non terminating, non recurring decimal represents an irrational number. So set of irrational numbers = $\mathbb{Q}^c = \{\text{numbers which are not rational}\}$

Define "Set of real numbers".

The union of rational and irrational numbers forms the set of real numbers. Thus a real number is either rational or irrational e.g. 2, $\sqrt{2}$, 0.54326, etc Where set of rational and irrational numbers is defined as Rational number: Any number which can represent in the form of $\frac{p}{q}$ where p, q belongs to set of integers and $q \neq 0$, As 7, $\frac{1}{2}$ etc Also a terminating, recurring decimal represents a rational number. Irrational number: Any number which can not represent in the form of $\frac{p}{q}$ where p, q belongs to set of integers and $q \neq 0$, for example π , $\sqrt{3}$ etc Also a non terminating, non recurring decimal represents an irrational number. So set of irrational numbers = $\mathbb{Q}^c = \{\text{numbers which are not rational}\}$

Set of complex numbers.

If x and y are real numbers, then $x + iy$ is called a complex number. x is called the real part and y is called the imaginary part. The complex number $x + iy$ is also written as an ordered pair (x, y) and is denoted by z . i.e., $z = x + iy$ where $i = (-1)^{1/2}$. Examples $2+4i, 5-3i, 2+2^{1/2}i$ etc.

What are the properties of complex numbers?

The Properties of Complex numbers are: Commutative Law for Addition, Commutative Law for multiplication, Additive Identity Exists, Multiplicative Identity Exist, Reciprocals (Multiplicative Inverses) Exist for nonzero complex numbers, Negatives (Additive Inverses) Exist for all complex numbers, Non Zero Product Law.

What is the Equality of Complex numbers?

Two complex numbers are equal if and only if their corresponding real parts and imaginary parts are separately equal. i.e., $a+ib=x+iy$ if and only if $a=x$ and $b=y$

What is an improper subset?

An improper subset is identical to the set of which it is a subset. Or in other words any set is a subset of itself and it is called an improper subset. For example: Set A: {1, 2, 3, 4, 5} Set B: {1, 2, 3, 4, 5} Set B is an improper subset of Set A and vice versa.

Is an empty set subset of every set?

Yes, an empty set is the subset of every set. The subset of an empty set is only an empty set itself

B is a proper subset of C if the cardinal number of C is 10 what is the maximum number of elements in B?

Since B is subset of C so every element of B is contained in C and given B is a proper subset of C so by definition every element of B is contained in C and B is not the same as C. The cardinal number of a set is the number of elements in the set. In this case, C has 10 elements, so B has at most 9 elements.

Why null set is not considered as an element of any set even though it is a subset of every set?

: Consider a set say, $A = \{1, 2, 3, 4\}$ of 4 elements. The subsets of A are : $\{\}, \{1\}, \{2\}, \{3\}, \{4\}, \{1,2\}, \{1,3\}, \{1,4\}, \{2,3\}, \{2,4\}, \{3,4\}, \{1,2,3\}, \{1,2,4\}, \{2,3,4\}, \{1,3,4\}, \{1,2,3,4\}$. This is true that the null set $\{\}$ is a subset. But how many elements are in the null set? 0 elements, this is why the null set is not an element of any set, but a subset of any set. Using the above example, the null set is not an element of the set $\{1, 2, 3, 4\}$, true. $\{1\}$ is a subset of the set $\{1, 2, 3, 4\}$ but it's not an element of the set $\{1, 2, 3, 4\}$, either. Look at the distinction: 1 is an element of the set $\{1,2,3,4\}$ but $\{1\}$ (the set containing the number 1) is not an element of $\{1,2,3,4\}$. If we are just talking about sets of numbers, then another set will never be an element of the set. Numbers will be elements of the set. Other sets will not be elements of the set. Once we start talking about more abstract sets, like sets of sets, then a set can be an element of a set. Take for example the set consisting of the two sets $\{\text{null}\}$ and $\{1, 2\}$. The null set is an element of this set.

Is empty set is proper subset or not?

Yes, empty set is proper subset of any non empty set say X. Since empty set is subset of X and does not equal to X.

Show $|A \times B| = |A| \times |B|$

Number of members of set $A \times B$ is equal to multiplication of number of members of A and number of members B. Where $A \times B$ is set of Cartesian product of A and B.

Let $A = \{1, 2\}$ and $B = \{x, y\}$ Then $|A|=2, |B|=2$ and $A \times B = \{(1,x), (1,y), (2,x), (2,y)\}$ so $|A \times B| = 4 \dots (1)$ And $|A| \times |B| = 2 \times 2 = 4 \dots (2)$ From (1) and (2) $|A \times B| = |A| \times |B|$.

How does to convert a decimal number into fraction form?

Step1: To eliminate decimal. For it follow the rules, First note that how many digits are there after decimal points? If 1, divide the given decimal number by 10 If 2, divide the given decimal number by 100. If 3, divide the given decimal number by 1000. and so on
Step2: Now simplify it such that nominator and denominator are relatively prime.

Example convert 3.25 into fraction form 3.25 Step 1: After decimal point there are 2 digits so dividing it by 100. So we have 325/100 Step 2: After simplification we have 13/4

Define membership table and truth table.

Membership table: A table displaying the membership of elements in sets. Set identities can also be proved using membership tables. An element is in a set, a 1 is used and an element is not in a set, a 0 is used. Truth table: A table displaying the truth values of propositions

What are the relations on sets?

Following are some relations on sets 1. Union of sets 2. Intersection of sets 3. Disjoint sets 4. Difference of two sets (Relative complement) 5. Symmetric Difference of two sets 6. Complement of a set, etc

What is an integer?

Integers are the whole numbers, negative whole numbers, and zero. For example, 43434235, 28, 2, 0, -28, and -3030 are integers, but numbers like 1/2, 4.00032, 2.5, Pi, and -9.90 are not. We can say that an integer is in the set: {...3,-2,-1, 0,1,2,3...} (The three dots mean you keep going in both directions.) It is often useful to think of the integers as points along a 'number line. Note that zero is neither positive nor negative.

Differentiate the proper and improper subset.

Proper subset: If A is a subset of B and B contains at least one element which is not an element of A. Then A is a proper subset of B. Improper subset: If A is a subset of B and A=B then we can say that A is an improper subset of B. So every set is an improper subset of itself. Also empty or { } is an improper subset of every set. So that An improper subset is a subset containing every element of the original set. A proper subset contains some but not all of the elements of the original set. Every Set has necessarily two subsets empty and the Set itself, thus every set is known as improper subset of itself and any other subset is called Proper Subsets.

What is interest?

Interest is the cost of borrowing money. An interest rate is the cost stated as a percent of the amount borrowed per period of time, usually one year. The prevailing market rate is composed of: 1. The Real Rate of Interest that compensates lenders for postponing their own spending during the term of the loan. 2. An Inflation Premium to offset the possibility that inflation may erode the value of the money during the term of the loan. A unit of money (dollar, peso, etc) will purchase progressively fewer goods and services during a period of inflation, so the lender must increase the interest rate to compensate for that loss.. 3. Various Risk Premiums to compensate the lender for risky loans such as those that are unsecured made to borrowers with questionable credit ratings, or illiquid loans that the lender may not be able to readily resell.

What is simple interest?

Simple interest is calculated on the original principal only. Accumulated interest from prior periods is not used in calculations for the following periods. Simple interest is

normally used for a single period of less than a year, such as 30 or 60 days. Simple interest = $p * i * n$ where: p = principal (original amount borrowed or loaned) i = interest rate for one period n = number of periods

What is compound Interest?

: Compound interest is calculated each period on the original principal and all interest accumulated during past periods. Although the interest may be stated as a yearly rate, the compounding periods can be yearly, semiannually, quarterly, or even continuously. You can think of compound interest as a series of back-to-back simple interest contracts. The interest earned in each period is added to the principal of the previous period to become the principal for the next period. For example, you borrow \$10,000 for three years at 5% annual interest compounded annually.

What is Present Value?

Present Value is an amount today that is equivalent to a future payment, or series of payments, that has been discounted by an appropriate interest rate. Since money has time value, the present value of a promised future amount is worth less the longer you have to wait to receive it. The difference between the two depends on the number of compounding periods involved and the interest (discount) rate. $PV = FV [1 / (1 + i)^n]$
Where: PV = Present Value FV = Future Value i = Interest Rate Per Period n = Number of Compounding Periods

What is Future Value?

Future Value is the amount of money that an investment made today (the present value) will grow to by some future date. Since money has time value, we naturally expect the future value to be greater than the present value. The difference between the two depends on the number of compounding periods involved and the going interest rate. $FV = PV (1 + i)^n$
Where: FV = Future Value PV = Present Value i = Interest Rate per Period n = Number of Compounding Periods

What is Accumulated Value?

What your money is worth after it earns interest, dividends, or capital gains. Includes the amount you started with, plus any increase.

How to solve linear equations?

The most important consideration with equations: No matter what kind of equation you're dealing with -- linear or otherwise -- whatever you do to the one side, you must do the exact same thing to the other side! Equations are like toddlers in this respect: You have to be totally, totally fair! Whatever you do to an equation, do the S A M E thing to B O T H sides of that equation!

What are the basic algebraic operations?

: We can say that the "basic" algebraic operations you must master are: • addition (of two or more terms or expressions) • subtraction (of one term or expression from another) • multiplication (of one term or expression by another) In the case of multiplication, it turns out to be useful not only to start with two expressions and be able to write down the

result of multiplying them together, but also, to be able to start with an expression and rewrite it as the product of two or more factors. • division (of one term or expression by another – this leads to the whole subject of working with fractions containing literal symbols.) • manipulating radicals or roots, particularly square roots, of algebraic expressions

What is ratio?

A ratio is a comparison of two numbers. We generally separate the two numbers in the ratio with a colon (:). Suppose we want to write the ratio of 8 and 12. We can write this as 8:12 or as a fraction $8/12$, and we say the ratio is eight to twelve.

What is proportion?

A proportion is an equation with a ratio on each side. It is a statement that two ratios are equal. $3/4 = 6/8$ is an example of a proportion.

What is rate?

A rate is a ratio that expresses how long it takes to do something, such as traveling a certain distance. To walk 3 kilometers in one hour is to walk at the rate of 3 km/h. The fraction expressing a rate has units of distance in the numerator and units of time in the denominator.

What is statistics?

Statistics as a discipline is the development and application of methods to collect, analyze and interpret data. Modern statistical methods involve the design and analysis of experiments and surveys, the quantification of biological, social and scientific phenomenon and the application of statistical principles to understand more about the world around us.

Is statistics hard?

No! Questions like this invariably lead to self-fulfilling prophecies. Tell yourself statistics is hard, and it's hard. Tell yourself statistics is easy, and it's easy! As with most activities rich enough to demand formal study, there are traps for the unwary that must be avoided. Fall into them at the beginning, and statistics is hard. Avoid them from the outset, and you'll wonder what the fuss is all about. The amount of success and the speed with which you'll achieved it depend in large part on how quickly these particular lessons are learned.

1. Statistics is as much about philosophy as about anything else. There are many ways to analyze data. The two major camps split themselves into frequentists and Bayesians, but there are many flavors of each as well as other camps, such as the decision-theorists and those who favor the likelihood approach. The reason for these different approaches has to do with questions like, "What is the probability that a particular theory is true?" Bayesians will answer that question with a number. Frequentists will say that the question is meaningless. The theory is either true or not. It can be a worthwhile exercise to spend a few minutes (hours, years, professional lifetimes,...) considering what is meant by "the probability that a theory is true". Problems ensue when people forget about what is allowed under what system and try making statements about the probability of something being true while conducting a frequentist analysis.
2. Statistics is backwards! One thing

most people (even statisticians!) would like to do is describe how likely a theory or hypothesis might be in light of a particular set of data. This is not possible in the commonly used classical/frequentist approach to statistics, which is the approach taken in these notes. Instead, statistics talks about the probability of observing particular sets of data, assuming a theory holds. We are not allowed to say, "Because I've seen these data, there is only a small probability that this theory is true." Instead, we say, "The probability of seeing data like these is very small if the theory is true." This means we need methods for translating this latter type of statement into a declaration that a theory is true or false. As a result... Statistical methods are convoluted! In order to show an effect exists, statistics begins by assuming there is no effect. Prior to collecting data, rules are chosen to decide whether the data are consistent with the assumption of no effect. If the data are found to be inconsistent with the assumption, the assumption must be false and there is, in fact, an effect! As a result, it is easy to argue that statistics is about a whole lot of nothin'! To show that an effect or difference exists, classical or frequentist statistics begins by asking what would happen if there were no effect...nothing...in exquisite detail. The analyst compares study data to what is expected when there is nothing. If the data are not typical of what is seen when there is nothing, there must be something! Simple? Maybe. Intuitive? Certainly not! Does it have to be done this way? Only because the consensus at the moment is that this is the approach that makes the most sense. Another worthwhile exercise is to spend a few minutes (hours, years, professional lifetimes,...) thinking about how it might be done differently.

3. Failing to find an effect is different from showing there is no effect! In the convoluted way of showing an effect exists, a statistician draws up a list of all of the reasonable ways that the observed data could have been generated. If one of these possibilities is "no effect", it is said that the statistical test fails to demonstrate an effect. If the data could reasonably have been generated without an effect being present, the data fail to demonstrate an effect. An effect can be declared as having been demonstrated only when the possibility of "no effect" has been ruled out. When people fail to demonstrate an effect (that is, "no effect" can't be ruled out), the data are sometimes misinterpreted as showing that there is no effect. These are two different things. "Failing to show an effect" means just that--"no effect" is among the list of possibilities, which might also include huge effects of great importance. However, because "no effect" has not been ruled out, it cannot be said that an effect has been demonstrated, regardless of what the other possibilities are! Showing that "there is no effect" means something more than having "no effect" among the possibilities. It also means that all possibilities of practical importance have been ruled out. The only other possibilities are of no practical importance. A typical misstatement is, "There is no effect," when the analyst should be saying, "The data failed to demonstrate an effect." The distinction is critical. If there is no effect, there is no more work to be done. We know something--no effect. The line of inquiry can be abandoned. On the other hand, it is possible to fail to demonstrate an effect without showing that there is no effect. This usually happens with small samples. This is best illustrated by an example. Suppose a researcher decides to compare the effectiveness of two diet programs (W and J) over a six-month period and the best she is able to conclude is that, on average, people on diet W might lose anywhere from 15 pounds more to 20 pounds less than those on diet J. The researcher has failed to show a difference between the diets because "no difference" is among the list of possibilities. However, it would be a mistake to say the data show

conclusively that there is no difference between the diets. It is still possible that diet W might be much better or much worse than diet J. Suppose another researcher is able to conclude that, on average, people on diet W might lose anywhere from a pound more to a half pound less than those on diet J. This researcher, too, has failed to show a difference between the diets. However, this researcher is entitled to say there is no difference between the diets because here the difference, whatever it might actually be, is of no practical importance. This example demonstrates why it is essential that the analyst report all effects that are consistent with the data when no effect has been shown. Only if none of the possibilities are of any practical importance may the analyst claim "no effect" has been demonstrated. If these hints to the inner workings of statistics can be kept in mind, the rest really is easy! As with any skill, practice makes perfect. The reason seasoned analysts can easily dismiss a data set that might confound novices is that the experienced analysts have seen it all before...many times! This excerpt from *The Learning Curve* by Atul Gawande (*The New Yorker*, January 28, 2002, pp 52-61) speaks directly to the importance of practice. There have now been many studies of elite performers--concert violinists, chess grandmasters, professional ice-skaters, mathematicians, and so forth--and the biggest difference researchers find between them and lesser performers is the amount of deliberate practice they've accumulated. Indeed, the most important talent may be the talent for practice itself. K.Anders Ericsson, a cognitive psychologist and expert on performance, notes that the most important role that innate factors play may be in a person's willingness to engage in sustained training. He has found, for example, that top performers dislike practicing just as much as others do. (That's why, for example, athletes and musicians usually quit practicing when they retire.) But, more than others, they have the will to keep at it anyway. I and others are good at what we do because we keep doing it over and over (and over and over until we get it right!). Persevere and you will succeed. For students, this means working every problem and dataset at their disposal. For those who have completed enough coursework to let them work with data, this means analyzing data every time the opportunity presents itself.