MPYE – 001
LOGIC

Assignment – 2
Notes:
i) Answer all five questions
ii) All questions carry equal marks
iii) For every question, refer to the texts and write down the assignment-responses in your own words.
iv) Answers to question no.1 and 2 should be in about ***500 words*** each

1. Explain the general characteristics of dilemma. Discuss the methods used for avoiding dilemma. 20

Dilemma, in traditional, logic, any one of several forms of inference in which there are two major premises of hypothetical form and a disjunctive ("either . . . or") minor premise. For example:

If we increase the price, sales will slump.
If we decrease the quality, sales will slump.
Either we increase the price or
we decrease the quality.
Therefore, sales will slump.

It is not necessary that a dilemma should have an unwelcome conclusion; but from its use in rhetoric the word has come to mean a situation in which each of the alternative courses of action (presented as the only ones open) leads to some unsatisfactory consequence. To take a familiar example, a person who is asked, "Have you stopped beating your wife?" is presented with a rhetorical dilemma. In this more complicated version of the dilemma, however, two unwelcome results are presented instead of one (*C,* above). Thus, the conclusion itself becomes a disjunction:

The dilemma consists of three propositions of which two constitute premises and third one is the conclusion. One of the premises is a conjunction of two hypothetical propositions and the other one is disjunctive. The conclusion is either disjunctive or simple. Since the dilemma consists of two hypothetical propositions conjoined by the word 'and', it is possible that two different propositions are found in place of antecedents and two different propositions are found in place of consequents. But it is not necessary that it should be so. It is likely that both propositions have a common consequent. If such consequent becomes the conclusion, then, the conclusion is a simple proposition.

Let us consider its so-called value before we proceed further with our analysis. The dilemma, in the strict sense of the word validity, is neither valid nor invalid. This is so because in this particular pattern there is no way of fixing the truth-value of the propositions. The dilemma does not contribute to the growth of knowledge. Nor does it help in testing what is in need of testing. Its significance is only restricted to rhetoric. The dilemma is an example of misuse or abuse of logic. Such a situation arises when a person, who is ignorant of logic, is confronted by an unscrupulous logician. It is most unlikely that the dilemma was ever seriously considered by any professional committed to logic. It, then, means that the dilemma has only negative significance, i.e., to know how not to argue.

characteristics of Dilemma: Its uniqueness is quite interesting. It has the following charactristics:
a) The first premise (p1) consists of two hypothetical propositions conjoined together.
b) The second premise (p2) is a disjunctive proposition. Its alternatives either affirm or deny the consequents of the hypothetical major premise.

c) The conclusion is either simple or disjunctive. It either affirms the consequents or denies.

Now, we can make a list of common features of different kinds of dilemma.

Dilemma	**Common Features**
1) Constructive	Different antecedents
2) Destructive	Different consequents
3) Complex	Disjunctive conclusion
4) Simple	Simple conclusion

Use of dilemma is restricted to some situations. When neither unconditional affirmation of antecedent nor unconditional denial of consequent is possible, logician may use this route. It indicates either ignorance or shrewdness. When we face dilemma, we only try to avoid, but not to refute. There are three different ways in which we can try to avoid dilemma. All these ways only reflect escapist tendency. Only an escapist tries to avoid a problematic situation. Therefore, in logic they do not carry much weight.

1) Escaping between the horns of dilemma: Two consequents mentioned may be incomplete. If it is possible to show that they are incomplete, then we can avoid facing dilemma. This is what is known as 'escaping between the horns of dilemma'. It should be noted that even when third consequent is suggested it does not mean that this new consequent is actually true. In other words, the new consequent also is questionable.

2) Taking the dilemma by horns: In this method of avoiding dilemma, attempts are made to contradict the hypothetical propositions, which are conjoined. A hypothetical proposition is contradicted when antecedent and negation of consequent are accepted. However, in this particular case it is not attempted at all. Moreover, since the major premise is a conjunction of two hypothetical propositions, the method of refutation is more complex. (The negation of conjunction will be introduced at a later stage. For the time being it is enough to know that in this particular instance there is no such attempt.)

3) Rebuttal of dilemma: It appears to be the contradiction of dilemma. But, in reality, it is not. In all these cases, the dilemma becomes a potent weapon to mislead the opponent in debate. Therefore, none of these methods amounts to the contradiction of opponent's view.

To conclude we can say that the dilemma is a medley of both types of conditional propositions, i. e., hypothetical and disjunctive, it should follow the basic rules of hypothetical and disjunctive syllogisms. It should affirm disjunctively the antecedents in the minor or deny disjunctively the consequents in the minor.

OR

Discuss the rules of categorical syllogism with proper examples. 20

A categorical syllogism is an argument consisting of exactly three categorical propositions (two premises and a conclusion) in which there appear a total of exactly three categorical terms, each of which is used exactly twice.

One of those terms must be used as the subject term of the conclusion of the syllogism, and we call it the minor term of the syllogism as a whole. The major term of the syllogism is whatever is employed as the predicate term of its conclusion. The third term in the syllogism doesn't occur in the conclusion at all, but must be employed in somewhere in each of its premises; hence, we call it the middle term.

Since one of the premises of the syllogism must be a categorical proposition that affirms some relation between its middle and major terms, we call that the major premise of the syllogism. The other premise, which links the middle and minor terms, we call the minor premise.

Consider, for example, the categorical syllogism:

No geese are felines.
Some birds are geese.
Therefore, Some birds are not felines.

Clearly, "Some birds are not felines" is the conclusion of this syllogism. The major term of the syllogism is "felines" (the predicate term of its conclusion), so "No geese are felines" (the premise in which "felines" appears) is its major premise. Simlarly, the minor term of the syllogism is "birds," and "Some birds are geese" is its minor premise. "geese" is the middle term of the syllogism.

Figure

Categorical syllogism have four possible figures depending on the position of the middle term. The "flying brick" is a good way to remember the four figures. The flying brick refers to the possible positions of the middle term without regard to quantity. The following is a picture of the flying brick.

```
M   M M   M
 \      /
  M M M M
```

Now with the predicate and subject terms introduced.

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M-P     P-M     M-P     P-M
 \                 /
S-M     S-M     M-S     M-S
S-P     S-P     S-P     S-P
First   Second   Third   Fourth
Figure  Figure   Figure  Figure
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Venn diagrams
AAA-1

Mood is AAA, figure I.

Major premise: All M is P
Minor premise: All S is M
Conclusion: All S is P

All Micronesians are Pacific Islanders
All Kosraens are Micronesians
All Kosraens are Pacific Islanders

When reading a syllogism, think of the statements this way:

Given that "All Micronesians are Pacific Islanders" is true and
Given that "All Kosraens are Micronesians" is true,
Therefore "All Kosraens are Pacific Islanders" is true.

In the above example the middle term M, the term in common to the major and minor premise, is Micronesians. The predicate P is Pacific Islanders. The subject S is Kosraens.
Diagramming the major premise

To diagram this syllogism start by laying out the major premise All Micronesians are Pacific Islanders or All M is P.

2. Give a detailed account of Negation, Conjunction, and Disjunction form of compound propositions with sufficient examples. 20

OR

Discuss the rule of quantification in detail. How would you apply these quantification rules? Illustrate with examples. 20

Modern logic recognizes three kinds of proposition; simple, compound and general. Let us deal with the last kind first. Propositions recognized by classical logic, viz. A, E, I and O are called general in modern logic. Simple sentence in logical sense is equivalent to what is simple in grammar. In other words, a simple sentence consists of one clause only and singular term in the place of subject.
Consider these statements.
1) Rathi is neat.
2) Rathi is neat and Rathi is sweet.
1 is a simple sentence whereas 2 is a compound sentence. A compound sentence consists of at least two components. Hence compound sentence in logical sense is equivalent to what grammar regards as compound sentence. Of course, the components of compound statement may themselves be compound.

There are different kinds of compound sentences, each requiring its own logical notation. Negation, conjunction, disjunction, conditional (implication), and biconditional are the kinds of compound sentence with which we are concerned. In this module an exhaustive description of the method of determining the truth-condition is attempted.

NEGATION: Negation deserves our special attention because it is a compound proposition in a unique sense though grammatically it is simple only. It is also a pointer to the exact meaning of and also the sense in which we use the *term compound*. Let us consider the following sentence.

India is not a member of the UN Security Council.

This is a negative sentence. It is evident that only in grammatical sense it is simple. Why does logic understand this sentence as compound? This way of understanding stands in need of clarification. Negation is not merely a compound sentence. It is truth-functionally compound, i.e. the truth of 3 depends upon the truth of some other statement. We must find out what that statement is.

CONJUNCTION: In conjunction sentences are joined by 'and'. The sentences so combined are called conjuncts. Sometimes propositions are misleading. The statement given below illustrates the point.

Shasi is intelligent and a hardworking student.

It may be tempted to think that the sentence above is a simple sentence. In reality, it is a compound sentence. The break-up is as follows.
a) Shasi is intelligent.

b) Shashi is a hardworking student.

The symbol we use for conjunction in this module is '^' (and), and not the dot '.'as is customary. There are many other words besides 'and' for which the symbol '^' is used. Some of these words are; but, yet, both, although, however, moreover, as well as, while, etc. Some examples are given below:

a. Hari is poor, but he is honest. P ^ H
b. It is hot, yet tolerable H ^ T
c. Shasi is intelligent although not very careful. I ^ ¬ C
d. Both Mohan and Mini are students of Logic. M ^ R

Since conjunction is a truth-functionally compound sentence, its symbol A is a truthfunctional connective. The truth-table of conjunctive proposition provides the truthcondition of conjunctive proposition.

DISJUNCTION : Disjunction (also called *alternation*) is a combination of two sentences with connective or linking the sentences. The two sentences so combined are called *disjuncts* (or *alternatives*). The symbol used for disjunction is 'v' (called wedge). Here are some examples and their symbolic representation:

a) Either I will send him an email or I will telephone him. M v T
b) Either it rains or we shall not go for an outing. R v ¬G
c) Either A is not honest or B is not telling the truth. ¬H v ¬T

The sentential connective 'v' can be used in two senses: a) Weak or inclusive sense. In this sense it means not *only either-or, but can be both*. Examples:

a) Either Ramu is a cynic or he is a liar.
b) Either Sita is poor or she is sincere.

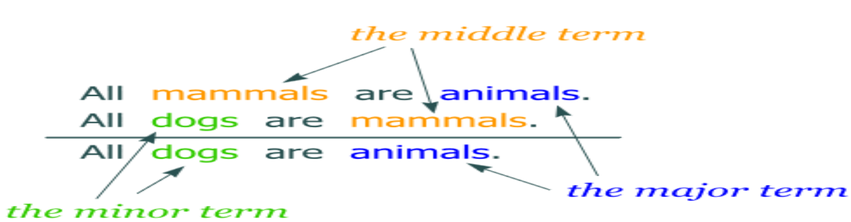
Let us make this inclusive sense more concrete: We can think of a mother asking her daughter to choose one of the two dresses A or B. The mother wants her daughter to choose one and reject the other. But we will not be surprised if the daughter says that she would take both. In contracts and other legal documents, this weak sense is made explicit by the use of the phrase 'and/or.'

3. Answer ***any two*** of the following questions in about ***250 words*** each:

a) How do you relate the major, minor and middle terms in a syllogism? 10

A **standard categorical syllogism** is a syllogism that consists of three categorical sentences, in which there are three terms, and each term appears exactly twice.

The three terms in a standard categorical syllogism are the **major**, the **minor** and the **middle** terms. The major term is the predicate term of the conclusion. The minor term is the subject term of the conclusion. The middle term is the term that appears twice in the premises.



A categorical syllogism is presented in standard form when its statements are arranged in the order of the major premise, the minor premise and the conclusion. Here the major premise is the premise that contains the major term, and the minor premise is the premise that contains the minor term.

All mammals are animals. ← *the major premise*
All dogs are mammals. ← *the minor premise*

All dogs are animals.

The **mood** of a standard categorical syllogism is determined by the types of categorical statements it contains. In the following example, the major premise is an **E** statement and the minor premise is an **I** statement. The conclusion is an **O** statement. So its mood is EIO

b) What is digital logic? Write a note on Boolean operators. 10

Digital logic is the representation of signals and sequences of a digital circuit through numbers. It is the basis for digital computing and provides a fundamental understanding on how circuits and hardware communicate within a computer. Digital logic is typically embedded into most electronic devices, including calculators, computers, video games, and watches. This field is utilized by many careers that work with computers and technology, such as engineers and repair technicians.

Programs and Courses

Digital logic is often offered as a course in engineering degree programs, such as electrical and computer engineering. Related majors may include electronic engineering technology and wireless communications technology. It's also offered as a certificate program for technicians. **Digital logic courses or programs** allow students to gain hands-on experience by building computer hardware through the use of algorithms and simple inputs. They learn how simple inputs of ones and zeros can be used to store information on computers, including documents, images, sounds, and movies.

Coursework trains students to input their algorithms into computer-assisted design (or CAD) software to create schematics of logic gates and circuits for a wide variety of electronic devices. Digital logic students also study combinatorial and sequential logic, memory elements, and flip-flops.

At the end of their studies, students are able to complete tasks such as:

- Wiring and checking the functionality of computer chips
- Specifying the output when the input is zero or one
- Determining the output of the gate

Boolean Operators are simple words (AND, OR, NOT or AND NOT) used as conjunctions to combine or exclude keywords in a search, resulting in more focused and productive results. This should save time and effort by eliminating in appropriate hits that must be scanned before discarding. Using these operators can greatly reduce or expand the amount of records returned. Boolean operators are useful in saving time by focusing searches for more 'on-target' results that are more appropriate to your needs, eliminating unsuitable or inappropriate. Each search engine or database collection uses Boolean operators in a slightly different way or may require the operator be typed in capitals or have special punctuation. The specific phrasing will be found in either the guide to the specific database found in Research Resources or the search engine's help screens.

AND—requires both terms to be in each item re turned. If one term is contained in the document and the other is not, the item is not included in the resulting list. (Narrows the search)

Example: A search on stock market AND trading includes results contains:

stock market trading; trading on the stock market; and trading on the late afternoon stock market
OR—either term (or both) will be in the returned document. (Broadens the search)
Example: A search on ecology OR pollution includes results contains: documents containing the world ecology (but not pollution) and other documents containing the word pollution (but not ecology) as well as documents with ecology and pollution in either order or number of uses.

NOT or AND NOT(dependent upon the coding of the database's search engine)—the first term is searched, then any records containing the term after the operators are subtracted from the results. (Be careful with use as the attempt to narrow the search may be too exclusive and eliminate good records)
. If you need to search the word not, that can usually be done by placing double quotes (<< >>) around it.
Example: A search on Mexico AND NOT city includes results contains: New Mexico; the nation of Mexico; US-Mexico trade; but does not return Mexico City or This city's trade relationships with Mexico.

c) Explain the fallacy of presumption with examples. 10

Fallacies of presumption are not errors of reasoning in the sense of logical errors, but are nevertheless commonly classed as fallacies. Fallacies of presumption begin with a false (or at least unwarranted) assumption, and so fail to establish their conclusion.

Arguments involving false dilemmas, complex questions, or circularity all commit fallacies of presumption: false dilemmas assume that there are no other options to consider; complex questions assume that a state of affairs holds when it may not; circular arguments assume precisely the thing that they seek to prove. In each case, the assumption is problematic, and prevents the argument from establishing its conclusion.

The fallacies of presumption also fail to provide adequate reason for believing the truth of their conclusions. In these instances, however, the erroneous reasoning results from an implicit supposition of some further proposition whose truth is uncertain or implausible. Again, we'll consider each of them in turn, seeking always to identify the unwarranted assumption upon which it is based.

Accident

The fallacy of accident begins with the statement of some principle that is true as a general rule, but then errs by applying this principle to a specific case that is unusual or atypical in some way.

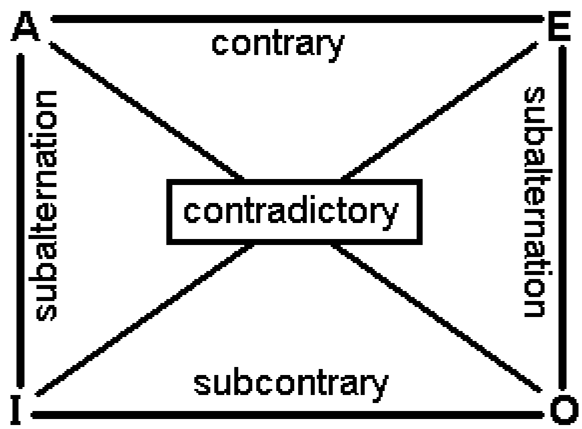
Women earn less than men earn for doing the same work.
Oprah Winfrey is a woman.
Therefore, Oprah Winfrey earns less than male talk-show hosts.

As we'll soon see, a true universal premise would entail the truth of this conclusion; but then, a universal statement that "Every woman earns less than any man." would obviously be false. The truth of a general rule, on the other hand, leaves plenty of room for exceptional cases, and applying it to any of them is fallacious.

Converse Accident
the fallacy of converse accident begins with a specific case that is unusual or atypical in some way, and then errs by deriving from this case the truth of a general rule.
•Dennis Rodman wears earrings and is an excellent rebounder.
•Therefore, people who wear earrings are excellent rebounders.
It should be obvious that a single instance is not enough to establish the truth of such a general principle.

d) Elucidate square of opposition. 10

The square of opposition is a chart that was introduced within classical (categorical) logic to represent the logical relationships holding between certain propositions in virtue of their form. The square, traditionally conceived, looks like this:



A propositions, or *universal affirmatives* take the form: *All S are P*.
E propositions, or *universal negations* take the form: *No S are P*.
I propositions, or *particular affirmatives* take the form: *Some S are P*.
O propositions, or *particular negations* take the form: *Some S are not P*.

Given the assumption made within classical (Aristotelian) categorical logic, that every category contains at least one member, the following relationships, depicted on the square, hold:

Firstly, A and O propositions are ***contradictory***, as are E and I propositions. Propositions are contradictory when the truth of one implies the falsity of the other, and conversely. Here we see that the truth of a proposition of the form *All S are P* implies the falsity of the corresponding proposition of the form *Some S are not P*. For example, if the proposition "all industrialists are capitalists" (A) is *true*, then the proposition "some industrialists are not capitalists" (O) must be *false*. Similarly, if "no mammals are aquatic" (E) is *false*, then the proposition "some mammals are aquatic" must be *true*.

Secondly, A and E propositions are ***contrary***. Propositions are contrary when they cannot *both* be true. An A proposition, e.g., "all giraffes have long necks" cannot be true at the same time as the corresponding E proposition: "no giraffes have long necks." Note, however, that corresponding A and E propositions, while contrary, are not contradictory. While they cannot both be true, they *can* both be false, as with the examples of "all planets are gas giants" and "no planets are gas giants."

Next, I and O propositions are ***subcontrary***. Propositions are subcontrary when it is impossible for both to be *false*. Because "some lunches are free" is false, "some lunches are not free" must be true. Note, however, that it is possible for corresponding I and O propositions both to be *true*, as with "some nations are democracies," and "some nations are not democracies." Again, I and O propositions are subcontrary, but not contrary or contradictory.

Lastly, two propositions are said to stand in the relation of ***subalternation*** when the truth of the first ("the superaltern") implies the truth of the second ("the subaltern"), but *not* conversely. A propositions stand in the subalternation relation with the corresponding I propositions. The truth of the A proposition "all plastics are synthetic," implies the truth of the proposition "some plastics are synthetic." However, the truth of the O proposition "some cars are not American-made products" does not imply the truth of the E proposition "no cars are American-made products." In traditional logic, the truth of an A or E proposition implies the truth of the corresponding I or O proposition, respectively. Consequently, the falsity of an I or O proposition implies the falsity of the corresponding A or E proposition, respectively. However, the *truth* of a particular proposition does not imply the truth of the corresponding universal proposition, nor does the falsity of an universal proposition carry downwards to the respective particular propositions.

4. Answer ***any four*** of the following in about ***150 words*** each:

a) Contrast between deduction and induction. 5

Deductive reasoning works from the more general to the more specific. Sometimes this is informally called a "top-down" approach. We might begin with thinking up a *theory* about our topic of interest. We then narrow that down into more specific *hypotheses* that we can test. We narrow down even further when we collect *observations* to address the hypotheses. This ultimately leads us to be able to test the hypotheses with specific data -- a *confirmation* (or not) of our original theories.

Inductive reasoning works the other way, moving from specific observations to broader generalizations and theories. Informally, we sometimes call this a "bottom up" approach (please note that it's "bottom up" and *not* "bottom**s** up" which is the kind of thing the bartender says to customers when he's trying to close for the night!). In inductive reasoning, we begin with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that we can explore, and finally end up developing some general conclusions or theories.

The following differences can be mentioned

1.Deduction is the reasoning from the general to the specific or individual while induction is the reasoning from the specific or individual to the general.

2.In deduction, the conclusion is accepted as the logical result of the premises while in induction the conclusion is formed from individual premises which may support it but does not make it true.

3.Deduction concludes with necessity while induction concludes with probability.

4.Deduction is the basis of the scientific method while induction is not.

b) What do you understand by the mood of a syllogism? 5

The word "mood" in syllogistic logic is used in three different senses. Firstly, the mood of a syllogism is determined by the quality and quantity of the constituent premises. Since the quality and quantity of any premise is reflected by its logical form, the mood of a given syllogism is obtained by writing the logical form of each of the constituent premises.

Accordingly; the mood of the argument (1) given above is "AA". This is so because the major and minor premises of the argument (1) are A-propositions. Similarly the mood of argument (2) given above is 'II'.

As we know that a syllogism contains two premises and each of the premises can admit any one of the four possible forms (viz. A, E, I or O), so the total number of possible configurations on moods would be $4^2 = 4 \times 4 = 16$. This may be exhibited in tabular form as shown below.

A A	E A	I A	0 A
A E	E E	IE	0 E
A I	E I	II	0 I
A 0	E 0	10	0 0

The mood in this sense is also well-know as mood in the wide sense.

Since there are four figures, the total number of moods would be 64. We shall soon see that out of these sixty four moods only nineteen moods are valid. These are as follows

Figure	Valid moods
First Figure	A A, E A, A I and E I
Second Figure	E A, A E, A I and A 0
Third Figure	A A, I A, A I, E A, 0 A, and EI
Fourth Figure	A A, A E, I A, E A and EI

We may note that out of these nineteen valid moods, the mood "E A" and "E Fare valid in all figures.

Definition of Mood (in the second sense)

The mood of a syllogism is determined by the quality and quantity of the constituent propositions. In other words, the mood of a syllogism is obtained by specifying the logical forms of each of the constituent propositions. Unlike the first sense, here we have to consider the logical form of conclusion in addition to the logical forms of the premises.

For example, in this sense the mood of the syllogism of argument (1) given above is "AAA". Similarly, the mood of argument (2) is "III". Here the first, second and third vowel respectively represents the logical form of major premise, minor premise and the conclusion. Since a syllogism consists of three propositions and each of these propositions admits any one of the four possible logical forms, the total number of possible moods would be $4^3 = 4 \times 4 \times 4 = 64$. This may be shown as given below.

AAA	E A A	I A A	0 A A
A A E	E A E	I AE	0 A E
A A I	E A I	I A I	0 A I
A A 0	E A 0	I A 0	0 A 0
A E A	E E A	IE A	0 E A
A E E	E E E	IE E	0 E E
A E I	E E I	IE I	0 E I
A E 0	E E 0	I E 0	0 E 0
A I A	E I A	II A	0 I A
A IE	E IE	HE	0 IE
All	E 11	III	0 II
A 10	E 10	110	0 10
A 0 A	E 0 A	I 0 A	0 0 A
A 0 E	E 0 E	I 0 E	OOE
A 0 I	E 0 I	10 I	0 0 I
A 0 0	E 0 0	10 0	0 0 0

Since there are four figures, the total number of moods in all would be 64 x 4 = 256. The mood in this sense is called mood in the wider sense. In this sense, there will be twenty four valid moods. These are as follows:

Figure	Valid moods
First figure	A A A, A A I, E AE, E AO, A II, EIO

Second figure	E A E, E A 0, A E E, AE 0, E I 0, A 0 0
Third figure	A A I, I A I, All, EA0,0 A0,EI0
Fourth figure	A A I, A EE, A E 0,1 A I, E AO, EIO

It may be noted that the moods "E A O" and "EIO" are valid in every figure.

Definition of mood (in the third sense)

The word "mood" is used in the sense of valid moods of syllogism. For example, the syllogistic argument (2) as given in this section has the configuration "II" (understanding mood in the wide sense) or III (understanding mood in the wider sense). Since neither of them is valid, they are not moods in the third sense. This sense of mood is mood in the narrow sense.

We note that the division of three senses of mood (viz wider, wide and narrow) is dependent on the admission of the total number of moods in all the four figures. Since the total number of moods in the second sense is the highest (i.e. 256) it is called mood in the wider sense. Similarly, the total number of moods in the first sense is sixty four. So it is called mood in the wide sense. Finally the mood in the third sense is called mood in the narrow sense as the total number of moods in all figures is the lowest.

c) Differentiate between reason and inference. 5

- **Reason** is the capacity for consciously making sense of things, applying logic, establishing and verifying facts, and changing or justifying practices, institutions, and beliefs based on new or existing information. We use reasons or reasoning to form **inferences** which are basically conclusions drawn from propositions or assumptions that are supposed to be true.

Inference is a general term representing the derivation of new knowledge from existing knowledge and axioms (i.e., rules of derivation) within a single step, and can be one of many kinds, such as, induction, deduction and abduction. For example, "modus tollens" is a rule of inference. Thus, one inference is the derivation of new knowledge using a single step using modus tollens.

Reasoning is in context of a goal (e.g., decide whether a propositional formula is satisfiable or not) and is carried out via a search process involving multiple inferences. Choices during such search have to be made such as which axiom to "fire" along with which knowledge in order to derive new knowledge.

d) Define Truth-table with an example. 5

truth table is a mathematical **table** used to determine if a compound statement is true or false. In a **truth table**, each statement is typically represented by a letter or variable, like p, q, or r, and each statement also has its own corresponding column in the **truth table** that lists all of the possible **truth** values.

We may not sketch out a truth table in our everyday lives, but we still use the logical reasoning that truth tables are built from to evaluate whether statements are true or false. Let's say we are told 'If it is raining outside, then the football game is cancelled.' We can use logical reasoning rules to evaluate if the statement is true or false and maybe make some backup plans! Let's check out some of the basic truth table rules.

Let's take the statement, 'It is raining outside.' This statement, which we can represent with the variable *p*, is either true or false.

p = It is raining outside

If it is raining, then *p* is true. If it isn't raining, then *p* is false.

The **negation** of a statement, called *not p*, is the statement that contradicts *p* and has the opposite truth value.

not p = It is not raining outside

If it is raining outside, then *not p* is false. If it isn't raining outside, then *not p* is true.

Here is how both of these possibilities are represented in a truth table in which *T* represents true, and *F* represents false:

Example 1

The art show was enjoyable but the room was hot.

Step 1: Use a variable to represent each basic statement.

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P: The art show was enjoyable.
Q: The room was hot.
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Step 2: Write the compound statement in symbolic form.

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P ^ Q
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Notice that even though the original sentence had the word "but" instead of "and" the meaning is the same.

Step 3: Determine the order in which the logic operations are to be performed.

In this case, only one logic operation is being performed.

e) Explain universal generalization 5
Universal Generalization is a rule of predicate logic that lets you go from a statement about an individual to a generalization, but there are restrictions on how it can be used. I will begin by demonstrating its valid use, then go on to show how it cannot be used.

Consider this argument:

All calicos are felines.
All felines are animals.
∴ All calicos are animals.

This is a valid argument, but we need a new rule to show its validity. This rule is Universal Generalization, and it lets us go from a premise about an individual to a universal conclusion. Here is how it is used to prove the validity of the argument just given above.

f) What do you understand by existential quantifier? 5

The **existential quantifier** is a symbol of symbolic logic which expresses that the statements within its scope are true for at least one instance of something. The symbol ∃, which appears as a backwards "E", is used as the existential quantifier.Existential quantifiers are normally used in logic in conjunction with predicate symbols, which say something about a variable or constant, in this case the variable being quantified.

The existential quantifier ∃ (which means "there exists"), differs from the universal quantifier ∀ (which means "for all").

Examples

For example, if the predicate symbol *Bx* is taken to mean "*x* is a ball", then we may formalize an expression using a existential quantifier:

$\exists xBx$

Translated back into English, this reads as "there is an *x* such that *x* is a ball", or more simply, "there is a ball".

We may formalize the expression "Some P are Q" using an existential quantifier and a conjunction:

$\exists x(Px \land Qx)$

This reads as "There exists an *x* such that *x* is a P and *x* is a Q", which may be literally as "at least one P is a Q", or more generally, "some P are Q". (In logic, the word "some" is almost always taken to mean "at least one".

Limit ∃ to one instance

The existential quantifier always means "at least one", which means that there may be one or more of the specified thing in existence. Sometimes, it may be useful to say that there is only one. In these cases, an existential quantifier is written as ∃!, which means "there exists exactly one". For example, we may say $\exists!xBx$, using the meaning presented above, to say "there is only one ball".

5. Write short notes on ***any five*** of the following in about ***100 words*** each:

a) Connotation of terms 4

A connotation is frequently described as either positive or negative, with regard to its pleasing or displeasing emotional connection. For example, a stubborn person may be described as being either *strong-willed* or *pig-headed*. c**onnotation** is a word's underlying meanings; it is all the stuff we associate with a word. So, while a rose is indeed a type of flower, we also associate roses with romantic love, beauty and even special days, like Valentine's Day or anniversaries. Connotations go beyond the literal to what we think and feel when we hear or see a word.

So, while Sistrunk Boulevard tells people in Fort Lauderdale where they are (denotation), the name also makes some people feel pride because it honors a well-regarded local figure in the black community (connotation). Others see the name Sistrunk as having negative connotations because of its history of blight and crime. For some in the community, that which we call a rose, by any other name does not smell as sweet.

b) Contrariety and subcontrariety 4

LAWS OF SUBCONTRARIETY Subcontrary opposition is one which exists between two particular propositions that differ only in quality. I and O propositions are subcontraries. ϖ If one is false, the other is true. ϖ If one is true, the other is doubtful, i.e., either true or false. ¬ If I is false, O is true. ¬ If I is true, O is doubtful. ¬ If O is false, I is true. ¬ If O is true, I is doubtful.
For example, the I will be “Some S are P” and the O will be “Some S are not P”. I – Some women are good reasoners. TRUE O – Some women are not good reasoners. TRUE I – Some women are good reasoners. FALSE O – Some women are not good reasoners. TRUE I – Some women are good reasoners. TRUE O – Some women are not good reasoners. FALSE

c) Multi-value logic 4

d) Hasty generalization 4

Hasty generalization is an informal fallacy of faulty generalization by reaching an inductive generalization based on insufficient evidence—essentially making a rushed conclusion without considering all of the variables. In statistics, it may involve basing broad conclusions regarding the statistics of a survey from a small sample group that fails to sufficiently represent an entire population.[1] Its opposite fallacy is called slothful induction, or denying a reasonable conclusion of an inductive argument (e.g. "it was just a coincidence").

Hasty generalization usually shows the pattern

1. X is true for A.
2. X is true for B.
3. Therefore, X is true for C, D, E, etc.

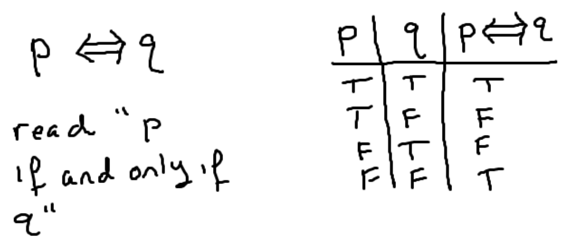
For example, if a person travels through a town for the first time and sees 10 people, all of them children, they may erroneously conclude that there are no adult residents in the town.

Or: A person is looking at a number line. The number 1 is a square number; 3 is a prime number, 5 is a prime number, and 7 is a prime number; 9 is a square number; 11 is a prime number, and 13 is a prime number. Therefore, the person says, all odd numbers are either prime or square. In reality, 15 is a counterexample.

e) Bi-conditional 4

A **biconditional** statement is defined to be true whenever both parts have the same truth value. The **biconditional** operator is denoted by a double-headed arrow . The **biconditional** p q represents "p if and only if q," where p is a hypothesis and q is a conclusion.

The biconditional – “p iff q” or “p if and only if q”



If and only if statements, which math people like to shorthand with “iff”, are very powerful as they are essentially saying that p and q are interchangeable statements. When one is true, you automatically know the other is true as well. Also, when one is false, the other must also be false. This is reflected in the truth table. Whenever the two statements have the same truth value, the biconditional is true. Otherwise, it is false.

The biconditional uses a double arrow because it is really saying “p implies q” and also “q implies p”. Symbolically, it is equivalent to:

$(p \Rightarrow q) \wedge (q \Rightarrow p)$

This form can be useful when writing proof or when showing logical equivalencies.

f) Invalidity 4

g) Instantiation

In programming, instantiation is the creation of a real instance or particular realization of an abstraction or template such as a class of objects or a computer process. To instantiate is to create such an instance by, for example, defining one particular variation of object within a class, giving it a name, and locating it in some physical place.

1) In object-oriented programming, some writers say that you instantiate a class to create an object, a concrete instance of the class. The object is an executable file that you can run in a computer.

2) In the object-oriented programming language, Java, the object that you instantiate from a class is, confusingly enough, called a class instead of an object. In other words, using Java, you instantiate a class to create a specific class that is also an executable file you can run in a computer.

3) In approaches to data modeling and programming prior to object-oriented programming, one usage of *instantiate* was to make a real (data-filled) object from an abstract object as you would do by creating an entry in a database table (which, when empty, can be thought of as a kind of class template for the objects to be filled in.)

4

h) Mood of a syllogism 4

The major premise, minor premise and the conclusion of a categorical syllogism are all categorical statements. Asdiscussedelsewhere, a categorical statement can be one of four types, A, E, I, or O. Since a syllogism uses only three statements at atime and there are four possible types of statements, there are therefore 64 possible arrangements of statement types. Eachof these arrangements is call a "mood" of the syllogism. The enumeration of the moods is left as an exercise for the student.These moods are expressed as a string of three letters corresponding to the types of the major premise, minor premise andthe conclusion respectively. For example, the mood "EAO" has an E type major premise, an A type minor premise, and an Otype conclusion.There are certain rules of syllogisms that limit which moods are valid. The valid moods in each of the four possible figuresare given in the table below. Just because a syllogism is in a "valid" mood does not mean that the conclusion will be true.Truth and validity as applied to logic are separate concepts. It is possible to have a valid syllogism and the conclusion befalse. Generally, this is because one of the premises is false or because the same terms have slight different wordings. It isalso possible to accidentally arrive at a true conclusion using an invalid syllogism