TURBOPREP MODULE 4 FOR CRITICAL REASONING (SAMPLE CHAPTER)

WHY IS LOGICAL REASONING SUCH A BIG DEAL FOR GRADUATE SCHOOL ADMISSION TEST-TAKERS?

No matter what career you choose to pursue – be it a nurse, a biochemist, a cytologist, an engineer, a lawyer, a consultant, or a business manager -- you will be required to maintain a healthy dose of skepticism about theories that involve single explanation that excludes alternative ones. Scientists are loath to accept one explanation for the evidence unless they have ruled out other possible explanations for the evidence. Trial lawyers are skeptical about the prosecution's self-serving 'single explanation' for the evidence and usually present alternative explanations for the evidence in the course of creating a 'reasonable doubt' about the explanation proffered by the prosecution. Business Consultants make a living by questioning the 'single explanation' arguments advanced by their clients. If the client wants to improve 'employee retention' by offering more benefits, the consultant will want to explore other explanations for why the company has issues 'retaining people'. The management style or prospects for growth within the organization could be the issues that the client may have overlooked.

In short, logical reasoning involves searching for 'alternative explanations' for the evidence or identifying 'alternative factors' that could have led to the same outcome. Take a look at the following argument:

> **"**In a recent citywide poll, fifteen percent more residents said that they watch television programs about the visual arts than was the case in a poll conducted five years ago**. During these past five years, the number of people visiting our city's art museums has increased by a similar percentage.** Since the corporate funding that supports public television, where most of the visual arts programs appear, is now being threatened with severe cuts, we can expect that attendance at our city's art museums will also start to decrease. Thus some of the city's funds for supporting the arts should be reallocated to public television."

You should bear in mind that the explanation that is offered in the argument may not always be explicit; it could be implied as in this argument. The argument offers ONE explanation for why the number of people visiting the city's museums increased by the same 15%: the public television show on visual arts. What could be other explanations for the same increase observed in attendance at museums? The museums advertised or lowered the admission price or had a tie-up with the local schools. It may very well be that the 15% increase in viewership may represent an increase of, say, 1000 viewers whereas the 15% increase in the visitors to the museums may represent, say, 20,000 people, Maybe, the locals watch the television program whereas the tourists from out of

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town go to museums. **Critical thinking is about considering alternative explanations for the same information presented as evidence**.

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FACTORS, CRITICAL FACTORS, ENABLING FACTORS

Factors are events or things that are causally linked to the evidence as presented in a chain of reasoning. Some of the factors that could be causally linked to admission to a law school are LSAT test scores, undergraduate GPA, motivation as demonstrated through application essays and campus visits, recommendations, and on-time applications. If the evidence is that John was denied admission to Yale Law school and the factor 'attributed' to the evidence was 'his low LSAT Score of 145', the argument implies that some of the other, equally relevant factors could not have resulted in the denial of admission to John.

All the factors identified are PLAUSIBLE in equal measure and the very act of suggesting the existence of other factors that could have led to the same outcome as used in the evidence decreases the PROBABILITY of the original factor identified in the argument.

CONCEPT OF PROBABILITY AS IT IS USED IN CRITIQUING THE ARGUMENTS

We all know that in probability, the larger the set of values the smaller the probability that any one of those values will be randomly selected. Likewise, the more explanations and factors we can think of for the evidence, the less the probability that the explanation or factor identified in the argument will have played out. The argument seems to imply that, in the absence of other factors addressed in the argument, the probability of the one factor to which the evidence is attributed appears to be 1 or certainty. But if you can identify 4 other factors, deficiency in any of which could have led to the same denial of admission, then the original explanation becomes one out of 5 equally plausible explanations. Therefore, the probability of the original explanation drops from 1 to 1/5. Weakening of an argument is done by decreasing the probability of the original explanation or of the original factor identified in the argument.

Weakening of an argument is done by identifying other factors and explanations that increase the set of factors and explanations that could have played out in producing the evidence and, in doing so, by decreasing the probability of the original explanation or of the factor.

Strengthening of an argument is done by asserting that the factor or explanation identified in the argument is more probable than other factors. This is usually done by providing additional evidence or information in support of the conclusion for a stated evidence.

The Assumption underlying an illogical argument attempts to make the conclusion logically certain (probability of 1) by DENYING the existence or probability of other factors.

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CONTEXT FOR INFORMATION

Context is defined as the parts of a discourse that surround a word or passage and can shed light on its meaning. It is also a set of interrelated conditions in which something exists or occurs. The conclusion of an argument has to be viewed in the CONTEXT of the evidence used in the argument. In Reading Comprehension passages, the main idea has to be viewed in the context of the rest of the information presented in the passage.

Context is the setting or the environment in which the conclusion exists and must be processed as such. To use an algebra analogy, context for information and the information that is provided exist as TERMS or chained values that cannot be separated. (We know that in algebra X + Y is a binomial expression in which X and Y are chained as terms and cannot be separated).

The test will be about your ability to process information in context. This is done by asking two questions:

- What is being said?
- Why is it being said?

If we consider a simple argument, "John scored 580 on the GMAT. Therefore, he will not be admitted to Harvard Business School', the conclusion 'he will not be admitted to HBS' must be viewed in the CONTEXT of 'John's GMAT Score of 580'. Context for information is referred to as SCOPE of information in the following pages. No matter what the nomenclature, you need to process information in context and not deal with the two chained values (evidence and conclusion) as if they exist in isolation.

If the conclusion of an argument is that the use of marijuana will cause cancer, we need to know 'why the use of marijuana would or could cause cancer'. The evidence will provide the context or the setting for the conclusion and the answer choice for any question has to be consistent with the context or the setting for the conclusion.

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LOGICAL REASONING FUNDAMENTALS
INVERSE, CONVERSE, AND CONTRAPOSITIVE

CONTRAPOSITIVES OF CONDITIONAL STATEMENTS ARE LOGICAL:

In a conditional Statement of the type "If X, then Y", **neither** the **converse** "If Y, then X" **nor** the **inverse** "If NOT X, then NOT Y" is necessarily true. But the 'converse of the inverse' – called 'CONTRAPOSITIVE' is necessarily true. The converse of the inverse statement is, "If NOT Y, then NOT X". The converse of the inverse is necessarily true.

Consider the following conditional statement:
"**All oranges are part of the Citrus family**."

The converse is: "*If the fruit is a part of citrus family, then it must be oranges.*" Of course, you can see that this converse of the original statement is not logical or necessarily true.

The Inverse of the original statement is: "*If the fruit is not orange, then it is not part of citrus family*." Of course, we can see this inverse of the original statement is not logical either; the fruit could be not orange but a lemon. It is still part of Citrus family.

If we do the **CONVERSE of the INVERSE** or the **CONTRAPOSITIVE,** then it is logical and necessarily true.
The **converse of the inverse** or CONTRAPOSITIVE statement above is:
"If the fruit is not part of the Citrus family, then it must not be orange." This CONTRAPOSITIVE (Converse of the inverse) statement is NECESSARILY TRUE.

If all Mexicans are Catholics, then the converse 'all Catholics are Mexicans' is not necessarily true; nor is the inverse 'if one is not a Mexican, one is not a Catholic." But if do the **converse of the inverse** and get, "If one is not a Catholic, then one is not a Mexican" this Contrapositive is LOGICAL and NECESSARILY TRUE.

The CONTRAPOSITIVE statement deduced from two or more statements, if true, will also be logical and necessarily true. Of course, if we have two or more factual statements that have common elements within them, we can **also** draw *logical* and *necessarily true* conclusions through **positive linkage** as follows:

Consider the following set of statements:

- **Strong patent laws provide protection to inventions.**
- **Protection to inventions encourages investments in plant and machinery.**
- **Investments in plant and machinery lead to higher productivity.**

The statements are of the type: A causes B; B causes C; C causes D.
The positive linkage is as follows:

A ➔ B ➔ C ➔ D leading to A ➔ D. **This is logical and must be true.**

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The inverse of the above linkage is:
NOT A ➔ NOT B ➔ NOT C ➔ NOT D leading to NOT A ➔ NOT D. Of course, this is not necessarily true because any inverse of a statement or set of linked statements is not necessarily true.

The converse of the above inverse statement is:

NOT D ➔ NOT C ➔ NOT B ➔ NOT A leading to NOT D ➔ NOT A. *THIS CONTRAPOSITIVE STATEMENT MUST BE TRUE as all contrapositives of a set of conditional statements are..*

In the context of the statements about patent laws, we get the linkages as follows:

Strong patent laws ➔ Protection to inventions ➔ Encourage investment ➔ Lead to higher productivity.
The above leads to: **Strong patent laws ➔ lead to higher productivity.** This conclusion is **necessarily true (must be true) and logical**.

The inverse of the above linkage is:
NOT have strong patent laws ➔ not provide protection to inventions ➔ NOT encourage investment ➔ NOT lead to higher productivity.
The above linkage leads to: Not have strong patent laws ➔ not led to higher productivity. Of course, this is not necessarily true. Higher productivity could be achieved with motivated employees or higher investments in plant and machinery could be caused by tax incentives, not patent laws.

If we take the converse of the inverse, we get:
Not have higher productivity ➔ not enough investment ➔ not provide protection to investments ➔ not have strong patent laws.

The **Contrapositive** linkage leads to: **If there is not higher productivity, then there are not strong patent laws**. This must be true because **strong patent laws must lead to higher productivity** through a causal mechanism described.

The logical conclusions we can reach from the passage through a positive linkage and a Contrapositive linkage are as follows:

- **Strong patent laws lead to higher productivity.**
- **Lack of higher productivity necessarily connotes lack of strong patent laws.**

Both are logical and necessarily true conclusions.

Let us analyze another set of conditions and draw conclusions through positive and contrapositive linkages:

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- If the fruit stand carries watermelons, then it must carry oranges or bananas or both.
- If the fruit stand carries either oranges or bananas, then it must not carry pears.
- If the fruit stand does not carry pears, it must carry tangerines.

If W ➔ O/B/O-B ➔ NOT P ➔ T
Leading to: **If W then T and not P.** This is a **logical conclusion** and a valid **inference that must be true.**

The inverse of the above construct is:
If NOT W ➔ NOT O/B/O-B ➔NOT NOT P ➔ NOT T
CAN BE WRITTEN AS:

IF NOT W ➔ NOT O/B/O-B ➔ P ➔ NOT T

Of course, this is not true to say that if the stand does not carry watermelons, it does not carry Tangerines. If W is not carried, then it could carry both P and T or NOT P but T and so on.

But if we take the **CONVERSE of the INVERSE** (**CONTRAPOSITIVE**), we get a linkage that is NECESSARILY TRUE:

NOT T ➔ P ➔ NOT B/B/0-B ➔ NOT W
Leading to the must be true conclusion that **IF THE STAND DOES NOT CARRY TANGERINES, THEN IT MUST NOT CARRY WATERMELONS**. This is because, if the stand carries watermelons, it must by default carry Tangerines

So, the LOGICAL conclusions we can arrive at from a set of conditional statements are as follows:
THROUGH A POSITIVE LINKAGE:
- If the stand carries Watermelons, then it must carry Tangerines but NOT Pears.

THROUGH A CONTRAPOSITIVE LINKAGE:
- If the stand does not carry tangerines, then it must not carry watermelons.

The above discussion leads to the following summary of logical determinations:

1. **IF ALL OF X IS Y, THEN ALL OF Y IS NOT NECESSARILY X BUT AT LEAST SOME OF Y IS X.**
   An example of this logic is as follows: IF all Americans speak English, all those who speak English are not necessarily Americans. But at least some of those who speak English are Americans.

2. **If ALL OF X IS Y, THEN, NOT X COULD BE Y.**
   An example of this logic is as follows: If all Mexicans are Catholics, then a person who is NOT MEXICAN could be catholic.

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3. **IF ALL OF X IS Y, THEN NOT Y IS NOT X.**
   An example of this logic is as follows: If all Business Schools require GMAT Scores for admission, then any school that does NOT REQUIRE GMAT Scores for admission cannot be a Business School.

4. **IF Y WILL NOT HAPPEN UNLESS X IS PRESENT, THEN Y MAY OR MAY NOT HAPPEN IF X IS PRESENT. (If the absence of a factor precludes an outcome, the presence of the factor may not guarantee the outcome)**

   An example of this logic is as follows: You cannot get into a Graduate School unless you take the standardized admission test. If you have taken the standardized admission test, you may or may not be admitted to a Graduate School if the score is not good enough or if other factors are not in order. If it is true that unless one saves money, one cannot buy a house, then the fact that someone saves money may not guarantee that the person can purchase a house. If the person does not save enough or if other emergencies crop up requiring the using the savings (such as a medical emergency), then the person may still not be able to purchase a house.

CAUSE AND EFFECT AND CORRELATION ARGUMENTS

CONTRAPOSITIVE OF CAUSE AND EFFECT STATEMENTS CREATES LOGICAL CONCLUSION

In **cause and effect** arguments of the type **X CAUSES Y**, the **converse tends** to weaken the argument and the **inverse** is the **assumption** of the argument. The **contrapositive**, as expected, will be a **logical conclusion**.

Consider the following statement:
"*Vaccination causes immunity against infectious diseases.*"

Inverse: **Not vaccination causes not immunity**. This is an assumption of the argument and confirmation of the assumption would strengthen the argument. This assumption is questionable here because immunity could arise from several other factors including prior exposure to the disease itself. If we can point it out, then we would have weakened the argument.

Converse of the original statement: **Immunity causes Vaccination**. This would be a weakening of the original statement if it made sense. Of course, this 'eggs cause chickens' does not make sense in the context of vaccines and immunity. If the converse does not create a sound weakening of the argument, we can weaken the argument by arguing against the inverse of the argument that becomes the assumption of the argument.

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Converse of the Inverse (contrapositive): **If there is no immunity against infectious diseases, then there was no vaccination**.
This must be necessarily true, given that vaccination always produces immunity against the disease.

CONTRAPOSITIVES OF STATEMENTS ABOUT CORRELATION ARGUMENTS GIVE RISE TO LOGICAL CONCLUSION AS WELL

Consider the following argument:
"The more television sets per capita a City has, the more residents stay indoors watching television, and the less the incidence of mosquito-borne encephalitis in the City."

↑ Television sets per capita ➔ ↑ Stay indoors ➔ ↓ incidence of encephalitis

The converse is:
↓ Incidence of encephalitis ➔ ↑ Stay indoors ➔ ↑ TV sets per capita

This converse construct is not compelling because the lower incidence of encephalitis may cause more people to stay outdoors and to watch less TV. The converse cannot serve as a weakening argument, nor is it logical.

The inverse of the original argument is:

↓ TV sets per capita ➔ ↓ stay indoors ➔ ↑ incidence of encephalitis

The inverse is: the fewer TV sets per capita, the less residents stay indoors, and the more the incidence of encephalitis. This is the assumption of the argument and, if confirmed, would provide a strengthening of the argument. *The inverse is probable in this case and, if strengthened with anecdotal information, the assumption is strengthened.*
The ***CONVERSE of the INVERSE*** – the **contrapositive** – is THE MORE the incidence of encephalitis, the LESS residents stay indoors and the FEWER TV sets per capita the city has.
This MUST BE TRUE if the original correlation is true.

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Let us consider another correlation passage, and try to determine the inverse, converse, and contrapositive implications.

"Partly because of bad weather and partly because most major growers of pepper had switched to pricier cocoa, pepper is in short supply. The price of pepper has risen in response and now equals the price of cocoa."

ORIGINAL	**INVERSE**	**CONVERSE**	**CONTRA+**
Poor Weather/ Switch by Growers to Cocoa	not poor weather/ growers stay with pepper. no Switch.	Rise in price of pepper	Price of pepper does Not rise
⇓	⇓	⇓	⇓
Shortage Of pepper	no shortage of pepper	shortage of pepper	no shortage of pepper
⇓	⇓	⇓	⇓
Price of Pepper Rises	Price of pepper does not rise.	poor weather/ causes switch From pepper to Cocoa	Growers did not switch/ not poor weather

Inference permitted by original construct:
"Poor weather and switch by major growers of pepper to cocoa caused the price of pepper to rise."

Inference permitted by contrapositive construct:
"If the price of pepper did not rise, then there was no shortage and then the major growers did not switch to cocoa and poor weather conditions did not exist."

The above inferences permitted by original and contrapositive constructs represent logical conclusions.

ASSUMPTION identification from INVERSE construct:
"If poor weather conditions did not exist and the farmers did not switch from pepper to cocoa, then the price of pepper did not rise."

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Let us consider another set of conditional statements and learn how to set up the inverse, converse, and contrapositive (converse of inverse) formulations.

"Raimundo must appear in every picture in which Selma appears. Tanya cannot appear in any picture in which Raimundo appears."

We can construct the original statements as:

If S ➔ then R ➔ then NOT T.

<u>Inference from positive construct:</u> If S then Not T. If Selma appears in a picture, then Tanya cannot appear in the same picture.

The Inverse of original construct:

If NOT S ➔ then Not R ➔ Then T.

The Converse of the original construct:

If NOT T ➔ then R ➔ then S

The Contrapositive construct (converse of the inverse)

If T ➔ then Not R ➔ then NOT S

INFERENCE PERMITTED BY CONTRAPOSITIVE FORMULATION:
If Tanya appears in a picture, then neither Raimundo nor Selma can appear in the same picture.

INFERENCE PERMITTED BY ORIGINAL FORMULATION:
If Selma appears in a picture, then Tanya cannot appear in that picture.

LSAT test-takers will be required to draw these inferences from the original and contrapositive formulations when they work on the analytical reasoning section and Logical Reasoning section. For GMAT and GRE test-takers, these basics will be tested as part of analysis of information.

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CRITICAL FACTORS AND ENABLING FACTORS

Factors, absence of which will preclude an outcome from actualizing, are called critical factors. The absence of an LSAT score will preclude admission to a Law School. **But the mere presence of an LSAT score will not necessarily lead to the desired outcome if other factors that come into play once the critical threshold is met are not in order**. For example, if one scored 150 on the LSAT, the mere existence of a test score will not guarantee the outcome (admission). If the score is below the school average or if other factors are not in order.

Consider the following argument:
"Autopsies performed on the bodies of those who had Alzheimer's disease reveal abnormal deposits of protein in the brain and extensive brain lesions. However, autopsies performed on the bodies of those who died without Alzheimer's disease also reveal abnormal deposits of protein in the brain but not lesions. Therefore, we can conclude that any person lives long enough will eventually suffer from Alzheimer's disease."

The context for the conclusion that 'anyone who lives long enough will eventually suffer from Alzheimer's disease' is the 'observation of abnormal deposits of protein in the brain area of both Alzheimer and non-Alzheimer patients. Will the mere presence of protein in the brain lead to Alzheimer's disease or do the abnormal deposits of protein require a trigger or 'enabler' to result in Alzheimer's disease? If the question requires that you weaken the argument, you would be looking for a reason why the deposits of protein alone cannot produce Alzheimer's disease in the absence of an enabling factor or a trigger. If the question required that you strengthen the argument, you would look for a reason why the mere presence of abnormal deposits of protein in the brain area alone is sufficient to produce Alzheimer's disease.

Consider another real-world example. "Unless you buy/obtain an airline ticket, you cannot travel to your destination by plane. If you bought or obtained an airline ticket, you may still get to the destination if the flight were to be canceled, or if you arrived late and missed the flight, or if you were prevented from boarding the aircraft because your name was inadvertently put on the 'watch list'.

Understand that there are several kinds of factors: factors, critical factors, and enabling factors. Some factors require the presence of other enablers to be able to produce the required outcome.

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NECESSARY AND SUFFICIENT CONDITIONS/FACTORS

We all know that there are some things necessary for something else to occur or exist and that there are certain things that are sufficient for certain other things to exist or occur.

Consider the following two words: Air, Life

If you want to create a relationship between the two, we can go as follows:

- Air is sufficient for Life to exist; or
- Air is necessary for Life to exist.

As you can see, the first construction is not logical because Air alone is not sufficient for life to exist. Of course, we all know that air is NECESSARY for life to exist.

So, the relationship between 'air' and 'life' is one of necessity, not of sufficiency. (GRE analogies section will test your ability to create logical relationships between words of the type discussed).

NECESSARY RELATIONSHIP

X is said to be necessary for Y if and only if the falsity (non-occurrence or non-existence) of X will guarantee or bring about the falsity of Y.

In the above discussion, Air is necessary for life because the absence of air will mean the absence of life.

A necessary condition is not a sufficient condition because many conditions may be necessary to create sufficiency.

Consider the following litany of necessary conditions:

- LSAT Score is necessary for admission to law school (because absence of LSAT score will guarantee the absence of admission to law school);
- Undergraduate GPA of a certain value is necessary for admission to law school;
- Recommendations are necessary for admission to law school;
- Admission essays are necessary for admission to law school;
- Application is necessary for admission to law school;
- Financial ability is necessary for admission to law school.

Notice that the falsity of a necessary condition will lead to the falsity of the action that follows but neither necessary condition alone is sufficient to cause admission to law school. If all necessary conditions have been covered in the above litany, then, together, they constitute sufficiency for law school admission.

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CONCEPT OF SUFFICIENCY

X is said to be sufficient to cause Y if and only if the truth of X will guarantee the truth of Y.

In conditional statements of the type "If X, then Y", the truth of X is sufficient to establish the truth of Y. If you have a statement that goes: "If Anna receives the letter, then Becky receives the flyer", then the truth of Anna receiving the letter is sufficient to conclude that Becky gets the flyer.

A polygon having 4 sides is sufficient to conclude that it is a quadrilateral.

If an integer has no more than two distinct factors, 1 and itself, then this 'truth' is sufficient to establish that the integer is a prime integer.

CONVERSE OF NECESSARY CONDITION CREATES SUFFICIENCY

Consider the following 'necessary' relationship:

A sound credit history is necessary for a mortgage loan.

The above statement implies that a sound credit history in and of itself cannot guarantee a mortgage loan. But, we can argue that the truth of mortgage loan is SUFFICIENT to argue that the person who got the loan has a sound credit history.

If a GMAT score of 700 is necessary for admission to Harvard Business School, then the admission to HBS is SUFFICIENT to argue that one has a GMAT score of 700 or better.

Purchasing a ticket is NECESSARY to win the lottery.
Winning the lottery is SUFFICIENT to argue that one bought a lottery ticket.

Taking the final exam is NECESSARY to graduate.
That one graduated is SUFFICIENT to establish that one took the final exam.

In an IF-THEN construction, the information that follows IF the sufficient condition and the information that follows THEN establishes necessary condition. Consider the following IF-THEN construction:
If you fail to register to take the LSAT, then you cannot take the LSAT.
You can see that the truth of 'failing to register to take the test' is sufficient to establish the truth of 'not being able to take the test'. The regimentation of this information would be: $\sim R \supset \sim T$

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COMBINATION OF NECESSARY FACTORS CREATING SUFFICIENCY

Consider the following two necessary factors to cause fire:

- Striking a match is necessary to cause fire.
- Presence of oxygen is necessary to cause fire.
- Together (S and O or S·O) they create the sufficient condition to cause fire.
- Our regimentation of this information would be: (S·O) ɔ F

We can have a set of IF-THEN statements that will allow us to draw inferences. Consider the following set of statements:

- If you do not take a prep course, then you will not get a score in the 90th percentile. ~ P ɔ ~ 90
- If you do not receive a score in the 90th percentile, you will not be admitted to a top-5 graduate school. ~90 ɔ ~A
- We can roll the two 'chain' statements to draw the inference: ~ P ɔ ~A

Cause and Effect relationship is a NECESSARY relationship

If X causes Y, then the falsity of X is sufficient to establish the falsity of Y.

Any information presenting 'cause and effect' relationship necessarily assumes or implies that that ~X is sufficient to conclude ~Y. Your strengthening answer will confirm this implication whereas your weakening answer will disprove this implication.

Consider the following argument:

> Throughout the 1950's, there were increases in the numbers of dead birds found in agricultural areas after pesticide sprayings. Pesticide manufacturers claimed that the publicity given to bird deaths stimulated volunteers to look for dead birds, and that the increase in numbers reported was attributable to the increase in the number of people looking.
>
> Which of the following statements, if true, would help to refute the claim of the pesticide manufacturers?

The argument goes that the Publicity caused people to look for dead birds. If publicity caused people to look for dead birds, then the lack of publicity should cause people to NOT look for dead birds. Our weakening strategy will attack this implication and state that there is no cause and effect relationship between publicity and finding of dead birds as alleged in the argument.

Let us take a look at another argument stating a causal relationship between two things and how we can identify the falsity of X leads to falsity of Y implication.

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Black Americans are, on the whole, about twice as likely as White Americans to develop high blood pressure. This likelihood also holds for westernized Black Africans when compared to White Africans.

Researchers have hypothesized that this predisposition in westernized Blacks may reflect an interaction between western high-salt diets and genes that adapted to an environmental scarcity of salt.

Which of the following statements about present-day, westernized Black Africans, if true, would most tend to confirm the researchers' hypothesis?

(A) The blood pressures of those descended from peoples situated throughout their history in Senegal and Gambia, where salt was always available, are low.

Notice that the information in the first paragraph lays out the medical facts and the information in the second paragraph is a theory explaining why westernized Black Africans and Black Americans are more prone to hypertension.

Let us understand the causal relationship posited in the hypothesis:

Gene adaptation to Scarcity of salt (+ interaction with high-sodium diet) CAUSES the increased propensity for hypertension.

The assumption or implication of this theory is that Falsity of X will bring about falsity of Y.

In other words, if there is NO gene adaptation to scarcity of salt, then there is no propensity to hypertension as a result of interaction with high-sodium western diet.

Our strengthening answer must support the assumption of the argument because the assumption will support the conclusion.

Our strengthening answer is as expressed in option A.

REMEMBER: When you are presented with a cause and effect relationship such as ***X causes Y***, be sure to understand the relationship presented and draw the implication that "***NOT X means NOT Y***". Your weakening answer will argue against this implication; your strengthening answer will support and validate this implication.

- Statements starting in ***IF, WHEN, WHENEVER*** indicate *sufficiency*.
- Statements containing ***THEN, MUST, REQUIRE, NEED, CAUSE*** indicate NECESSITY.

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PASSAGES THAT PRESENT NECESSARY AND SUFFICIENT RELATIONSHIPS AND THAT PERMIT INFERENCES CONSISTENT WITH THE DEFINITION OF NECESSARY AND SUFFICIENT CONDITIONS

Consider the following argument:

"It is important to happiness that one be faithful to one's beliefs. Infidelity consists in pretending to believe in something when one really does not."

If the above statements are true, then what can be logically concluded?

The first sentence needs to be understood as follows:

- Being faithful to one's beliefs is NECESSARY to create happiness.
- Our definitional interpretation is: Lack of faithfulness is sufficient to create lack of happiness.
- Lack of faithfulness = Infidelity = Pretending to believe in something that one does not.
- LOGICAL CONCLUSION: Infidelity creates unhappiness and given that infidelity is about pretending to believe in something that one does not, we can apply the chain rule and conclude that "pretending to believe in something when one does not creates unhappiness"

Consider another passage that needs to be understood in terms of necessary relationships.

Yeasts capable of leavening bread are widespread, and in the many centuries during which the ancient Egyptians made only unleavened bread, such yeasts must frequently have been mixed into bread doughs accidentally. The Egyptians, however, did not discover leavened bread until about 3000 B. C. That discovery roughly coincided with the introduction of a wheat variety that was preferable to previous varieties because its edible kernel could be removed from the husk without first toasting the grain.

The statement 'Yeasts capable of leavening bread are widespread' must be read as "yeasts are NECESSARY to leaven bread' and the capability needs to be understood in the context of other factors that may well be necessary.

The second statement confirms our read of the first statement by stating that even though yeasts were accidentally mixed into doughs, Egyptians did not make leavened bread. We need to bear in mind that other factors that are equally necessary were not present when yeasts were accidentally mixed with doughs.
The final statement tells us that Egyptians discovered leavened bread when they had a variety of wheat that DID NOT HAVE TO BE TOASTED. Our analysis of this information in the context of our understanding of information in the first two sentences would lead us to conclude that previously when yeasts were accidentally mixed into bread doughs,

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Egyptians had to toast the wheat grain and the toasting prevented the other necessary factors from taking effect. If the question asks you:

- How do you explain that Egyptians could make leavened bread by not toasting the grain, given that yeasts were necessary and accidentally mixed into the doughs before the discovery of new type of wheat?
-

You would state that the toasting of the grain prevented the other necessary factors to create leavened bread from having any effect. The correct answer choice actually read:

Heating a wheat kernel destroys its gluten, a protein that must be present in order for yeast to leaven bread dough.

As expected, the required explanation was about toasting or heating destroying another necessary factor. It turns out **(Y·G) ɔ L** ← Yeast AND Gluten together are sufficient to leaven bread while each alone may be necessary to leaven the bread.

Let us consider another argument::

- "If the Congress notices a federal department as underperforming, then it allocates additional funding to that department in the budget. Therefore, the public works department will receive additional funding from Congress this year."

The first statement of the argument is a IF-THEN statement and indicates that noticing by Congress that a department is underperforming is sufficient to allocate additional funding to that department.

(Congress notices a department as underperforming) ɔ (Allocate funding to that department)

The second statement is the conclusion, stating that the public works department will receive additional funding from Congress. Because the second statement is made in the context of the first statement that stipulates a **prior action** of Congress noticing a department as underperforming, the conclusion implies that the PWD will be noticed by Congress as underperforming so that it will receive funding. This is the assumption of the argument.

This type of argument is of the form: **"If X, then Y. Y. Therefore, X"**

You can also receive arguments of the type, "**If X, then Y. X. Therefore, Y"**

Learn to recognize the relationships expressed or implied in the stimulus and in the conclusion. Do not merely process sound bytes without processing the relationships described or implied.

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THE CONCLUSION OF THE ARGUMENT MAY IMPLY A RELATIONSHIP BETWEEN TWO DISPARATE ELEMENTS MENTIONED IN THE STIMULUS WHEN THE STIMULUS ITSELF DOES NOT, BY ITSELF, IMPLY SUCH A RELATIONSHIP

Consider the following argument:

> Nearly one in three subscribers to ***Financial Forecaster*** is a millionaire, and over half are in top management. Shouldn't you subscribe to *Financial Forecaster* now?

Notice that the first statement merely mentions that there are some subscribers who happen to be millionaire or in the top management. There is no relationship expressed or implied in the stimulus statement.

However, the second statement creates a relationship of the following type:

Reading the Financial forecaster is NECESSARY to become a millionaire or a top manager.

This is the assumption that underlies the taunt in the conclusion.

Be sure to recognize the relationships that are necessary and sufficient as expressed or implied in the information presented to you.

Let us analyze another argument expressing a relationship between X and Y and assuming that the relationship is one of sufficiency, not necessity.

- *Autopsies of patients who had Alzheimer's disease before they died indicated abnormal levels of protein deposits in their brains.* Therefore, anyone who has abnormal levels of protein deposits in their brains will eventually develop Alzheimer's disease and die from it.

Notice that the first statement simply mentions that people who died of the disease had ABNORMAL levels of protein in their brains but the second statement tries to create a sufficiency relationship between abnormal levels of protein and the disease.

The argument assumes that abnormal levels of protein are SUFFICIENT to cause Alzheimer's disease, not merely necessary. It implies the following relationship:

(Abnormal levels of protein in the brain) ɔ (Alzheimer's disease)

Your strengthening answer must confirm the Sufficiency relationship implied in the conclusion whereas your weakening answer must show that abnormal levels of protein are NECESSARY, not sufficient and that there may be other NECESSARY FACTORS that might create sufficiency along with abnormal levels of protein.

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We have learned in the foregoing pages that processing the relationships expressed or implied is essential in order to come up with the correct answers. Processing is also about the significance of the use of specific language in the statements.

PAY ATTENTION TO AUXILIARIES USED IN THE STATEMENTS

Auxiliary verbs such as ***COULD, WOULD, WILL, CAN, MAY, MIGHT*** need to be processed. In fact, when you work on Reading Comprehension passages, you will be required to pay attention to and process these auxiliary verbs.

COULD means 'likely can' and denotes a PROBABILITY of occurrence of an event.

WOULD means 'likely will' and connotes a probability of occurrence of an event. "Would" also may suggest an assumption that the author is making in advancing the argument.

WILL implies speculation that is based on a good degree of confidence. IF the statement is that if Perry's faction wins the elections, the nation WILL suffer militarily and if Terry's faction wins the elections, the nation WILL suffer economically. The use of WILL suggests speculation that is based on reasonable certainty. But the statement also implies that the nation COULD suffer economically if Perry's faction wins, and the nation could suffer militarily if Terry's faction wins the elections.

CAN implies a potential or confidence. "Replenishment of the gene pool of the cultivated wheat CAN be accomplished through tapping into the resources of the wild wheat' -- The statement connotes a degree of confidence in potentially enriching the gene pool of cultivated wheat through using the model of wild wheat.

MAY implies an uncertainty and a smaller probability. **MIGHT** is a weaker 'may'.

QUALIFIERS AND THEIR CONNOTATIONS

The QUALIFIER '**at most'** means 'equal to or less than'

The QUALIFIER '**at least'** means 'equal to or greater than'

SOME means a small proportion of the total population.

MOST means a significant proportion of the total population.

SOME, SOME, SOME does not cover the entire population. For example, if the statement goes: 'some are good cooks, some are gourmet cooks, and some are fast-food cooks', you should know that you have not covered the entire population of cooks.

SOME, OTHERS, THE REST cover the whole population.

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If the statement goes: "some are good cooks, others are gourmet cooks, and still others or the rest are fast-food cooks", then you have covered 100% of the group of cooks.

LOOK FOR DELIBERATE VAGUENESS OR AMBIGUITY IN THE ITEMS OF INFORMATION PROVIDED TO YOU

The test is about your ability to look for and identify words and phrases that are **interchangeably used** but are **not synonymous**. Deliberate attempts at creating ambiguities may involve dropping of a qualifier or introduction of a qualifier, or use of words that mean different things in different context.

Consider the following argument: "In a recent study, 40 handwriting analysts could not predict the **occupations** of 100 persons whose handwriting were analyzed Therefore, handwriting analysis is a poor way to predict the **personality-types** of job applicants". Notice that the argument implies that personality types and occupations are correlated in some fashion.

Consider another example: "Studies have shown that **sugars**, if consumed immediately after 45 minutes of continuous exercise may actually promote **burning of fact and lead to weight loss**. Therefore, people who drink aspartame drinks rather than soft-drinks containing **sugar** may be acting against their self-interest in pursuing **dietary goals'**.

Notice that the argument refers to a study about SUGARS (which are normally fructose found in fruits and juices) and then switches to a reference about SUGAR (notice the singular case noun here). The sugar found in soft-drinks may be processed sugar (sucrose) made from sugar-cane, and may not be interchangeably used with SUGARS that occur naturally in fruits and 100% orange juice. Another ambiguity that you should pay attention to is that the argument implies that dietary goals involve weight loss. A dietary goal may not necessarily involve weight loss or, in some instances, may actually involve weight gain. You need to look for, identify, and process these elements of deliberate vagueness that are found in the information provided to you.

Consider the following argument in which the word EXPLOITATION is used in two different connotations but interchangeably referred to:
"Your argument that unions protect workers against exploitation misses the point that **exploitation of workers** is just as natural as **exploitation of natural resources**". Notice that 'exploitation of workers' does not carry the same connotation as 'exploitation of resources'. When workers are exploited, they are not paid well or provided benefits or good working conditions. Exploitation of resources could mean complete utilization of resources. Logical and critical reasoning is about paying attention to and processing these subtleties. As well, *When you deal with the Argument essay in Analytical Writing Section, look for intended vagueness and interchangeable use of words and phrases, and question their use.*

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Procedures for identifying the underlying assumptions in illogical arguments:

1) Determine the manner in which the elements of the evidence have been interpreted or used by the author of argument to reach a conclusion. For example, if the evidence is about the results of a poll or survey, the manner in which the polling has been used by the author to reach the conclusion is that the author has taken for granted or assumed that the polling was done with a representative sample or that those polled were answering truthfully. If the evidence is about comparison of X and Y, then the author assumes that X and Y are apples and apples.

2) Rule of Symmetry: Connect the distinct elements that appear in the evidence and in the conclusion to form a sentence that would represent the assumption. Consider the following argument: "**All known living things** are **made up of the same basic kinds of carbon-based matter**. Therefore**, all living things** have the **same origin of life**." Notice that 'all living things' is a phrase that appears in the evidence and in the conclusion, and is not a distinct 'element' in either statement. The distinct phrase in the evidence is 'the make-up in terms of carbon based matter' and that in the conclusion is 'origin of life'. We need to connect these distinct elements into a relationship statement that would be the assumption of the argument. The assumption obtained by using the rule of symmetry is: **If living things are made up of same kinds of carbon-based matter, then they must have the same origin of life.** *We will explain this rule in greater detail in the following pages.*

3) Ascertain the implications of the elements such as nouns, verbs, and qualifiers used in the conclusion. Those implications necessarily represent the assumptions of the argument. For example, if a verb appears in the conclusion, determine whether a prior action is required in order for the action described in the verb can take place. In this situation, the prior action is necessarily implied and constitutes the assumption of the argument. If the conclusion is that "John will NOT be ADMITTED to Columbia Business School", the action of 'getting admitted' requires a prior action of making an application. The author assumes that John will make an application for admission to Columbia Business School.

4) If the conclusion is one explanation for the evidence, then the author necessarily rejects other explanations or other factors or other solutions. Consider the argument: "Internet contains content that is unsuitable for viewing by young children. Therefore, the government should regulate the Internet." In suggesting ONE WAY to deal with the problem of 'unsuitable content' on the Internet, the author assumes that the matter of unsuitable content cannot be dealt with through parental control or through technological means such as using user-sensitive filters.

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