

* The reference sources for all designs, concepts, models, and materials are found at <http://inferenceincourt.com>.

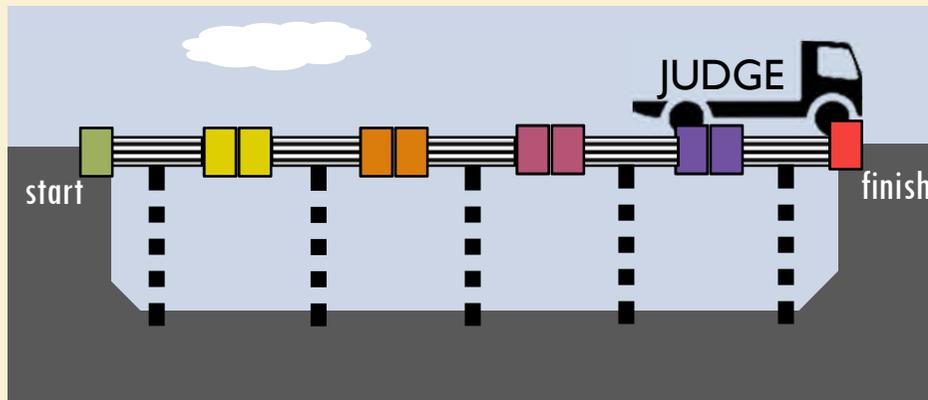
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Salem, Oregon

Prove It!*

*constructing stronger
lines of logical reasoning*



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**Logical reasoning depends on the underlying structural form of its sentences (premises).*

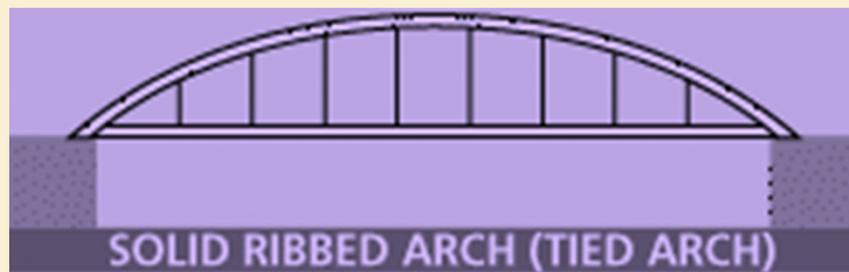
For a line of reasoning to be strong in court, it first needs to be logical. To be logical, the actual underlying form of the sentences that comprise the line of reasoning must comply, like parts of a bridge, with one of several strictly defined structural parameters. The creation of this logical structure is often guided by one's own intuitive sense of what is logical reasoning. But knowing precisely the actual logical form can permit the construction of sounder lines of reasoning.



**The structure of the logical form of the line of reasoning may not always be obvious.*

Just as the underlying structural design may not be readily apparent in the finished appearance of a bridge, the underlying logical structure of a structurally correct line of reasoning may not be immediately evident.

Without changing the meaning of the sentences, sometimes the form of the sentences needs to be adjusted, sentences that are only implied need to be added, or extraneous words need to be removed to reveal the logic.

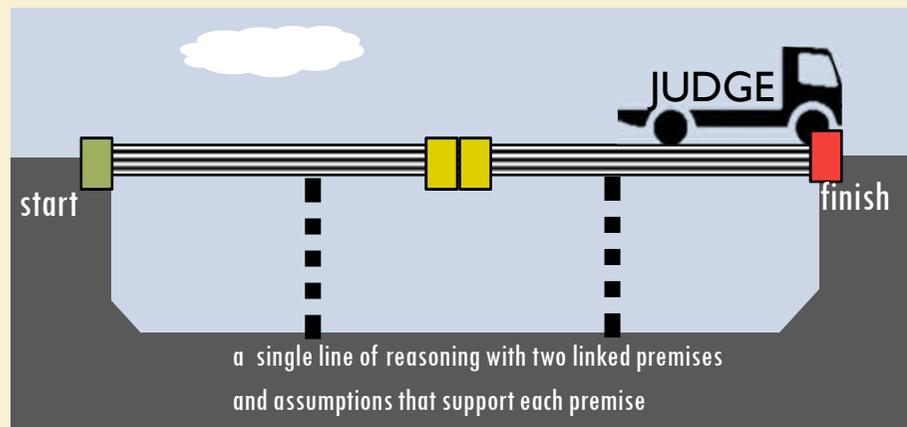


Infinity Loop Bridge, Zhuhai, China



Infinity Loop Bridge, Zhuhai, China

* The precise name of this categorical logical form is *Defeasible Class-Inclusion Transitivity (DCIT)*.

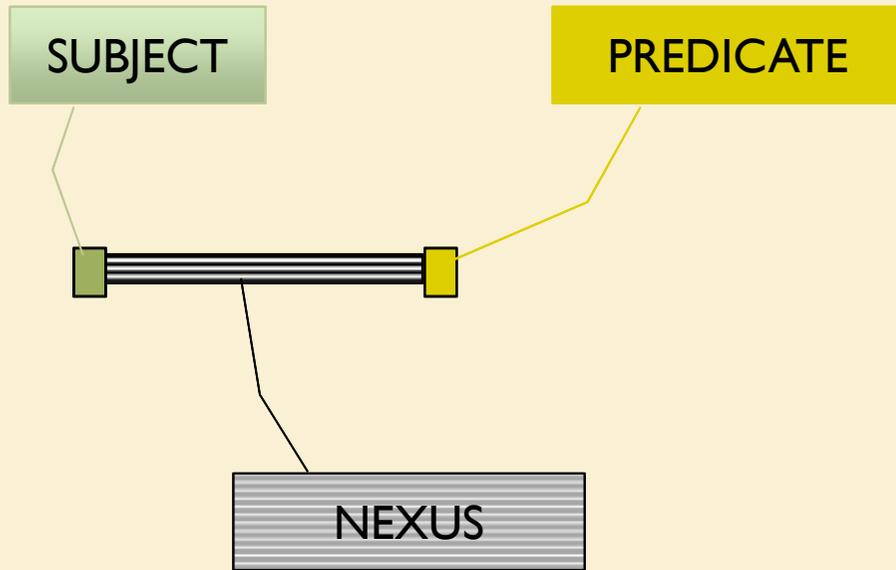


One type of underlying logical form (i.e., DCIT* (dee·kit)) resembles the design of a bridge constructed with cantilever spans.

Each *span* along with its two colored end-caps represents each of the sentences (premises) that link together to form the logical line of reasoning that justifies the conclusion.

And the *piers* beneath each span are the supporting assumptions for each linked premise in the line of reasoning.

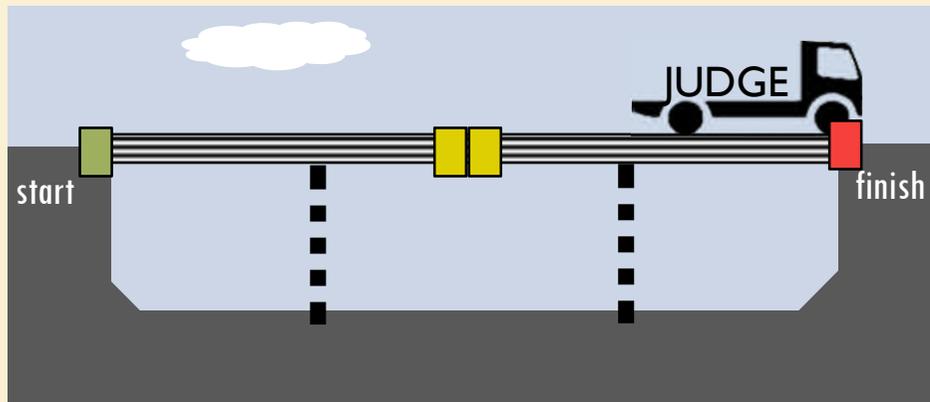
* Any sentence can be structured in this categorical form (Sommers & Englebretsen, 2000).

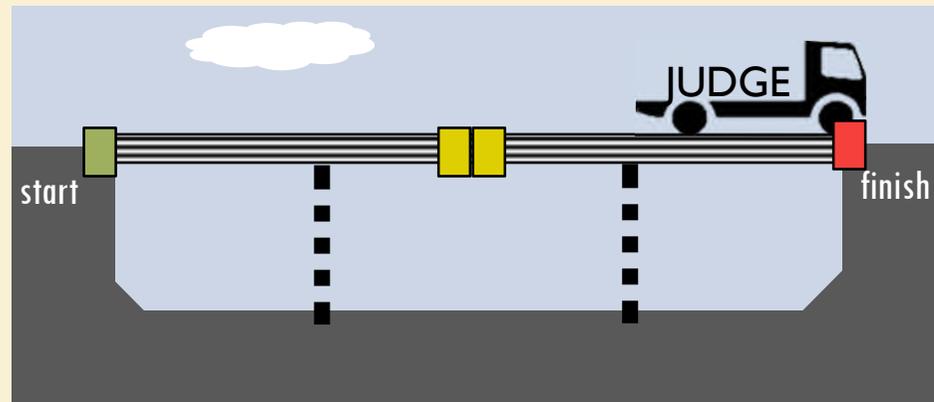
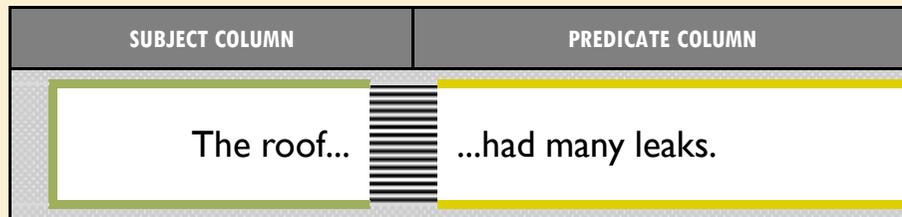
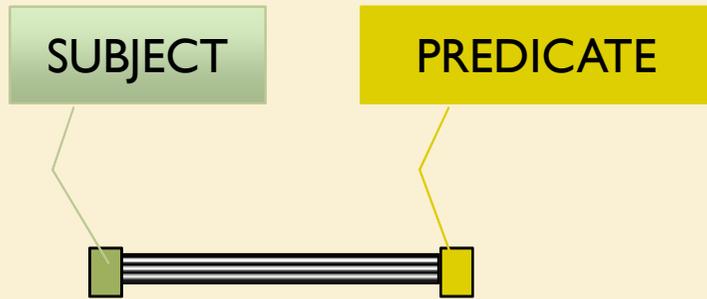


Each sentence (premise) of the line of reasoning consists of three parts*:

1. SUBJECT [phrase] of the premise (first end-cap);
2. PREDICATE [phrase] of the same premise (last end-cap); and,
3. NEXUS that joins them

SUBJECT COLUMN	PREDICATE COLUMN
The roof...	...had many leaks.



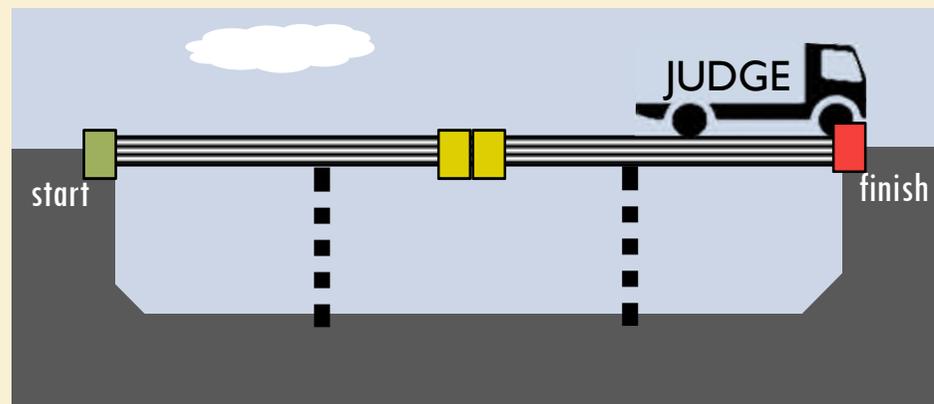
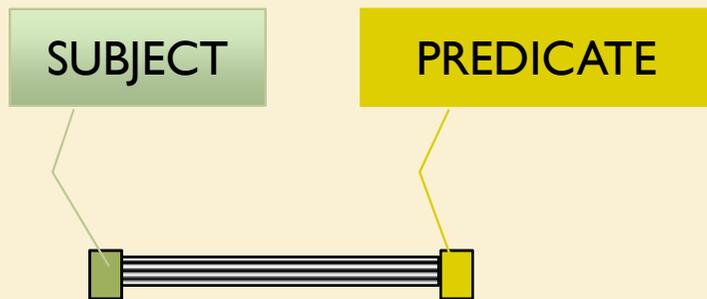


“The SUBJECT is a noun [phrase].
That's a person, place or thing.
It's who or what the sentence is about
And the PREDICATE is the verb [phrase].
That's the action word.
That gets the subject up and out.”



The Tale of Mr. Morton
Schoolhouse Rock

These are examples of parsing sentences into their SUBJECT [phrase] and PREDICATE [phrase] components.



SUBJECT COLUMN	PREDICATE COLUMN
The roof...	...had many leaks.

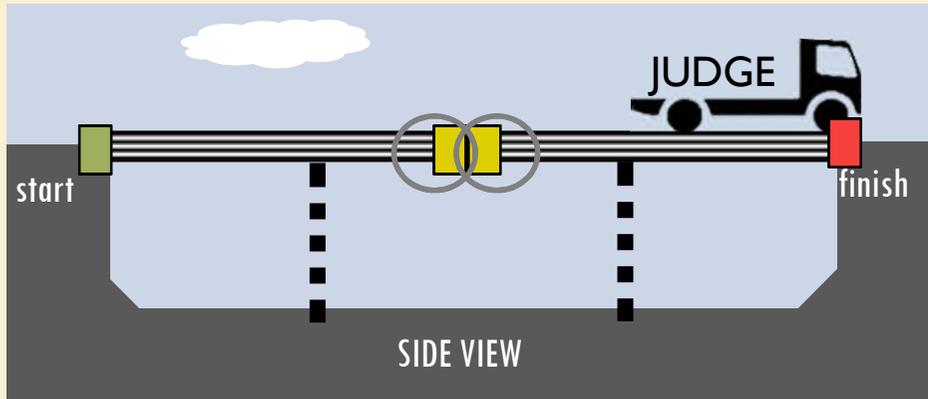
SUBJECT COLUMN	PREDICATE COLUMN
The comparable sales...	...needed too many adjustments.

SUBJECT COLUMN	PREDICATE COLUMN
The sale...	...was an arms-length transaction.

SUBJECT COLUMN	PREDICATE COLUMN
The seller...	...was considering bankruptcy.

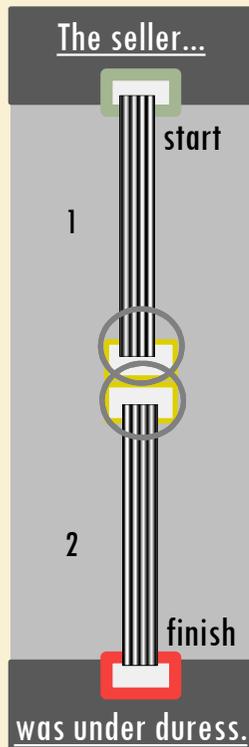
SUBJECT COLUMN	PREDICATE COLUMN
The cost approach...	...indicated an unrealistic estimate of depreciation.

Each premise is linked to the next one in a specific manner and order.



The sentences (premises) of the DCIT line of reasoning are arranged in a specific order by linking each other back to front.

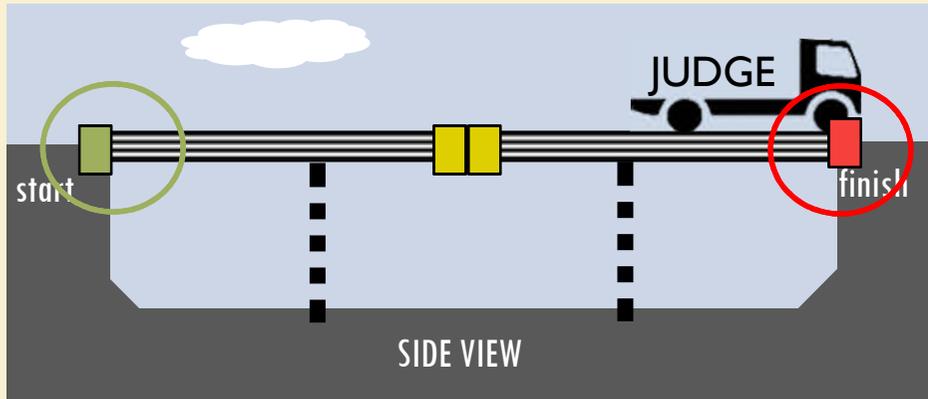
This linkage is created by the **PREDICATE** of one sentence becoming the **SUBJECT** of the next sentence in the line of reasoning with the addition of universals [e.g., Any, All, One].



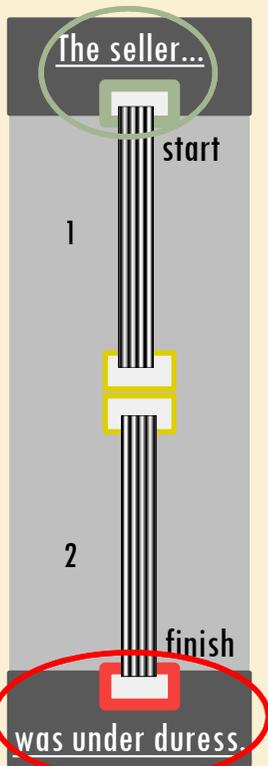
	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller...	... was considering bankruptcy.
2	[Any (all/one) who (that)] was considering bankruptcy..	...was under duress.
Therefore, CONCLUSION		
	The seller...	...was under duress.

	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller..	... was considering bankruptcy.
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	...was under duress.
Therefore, CONCLUSION		
	The seller..	...was under duress.

The SUBJECT [phrase] and PREDICATE [phrase] of the CONCLUSION bound the ends of the line of reasoning.

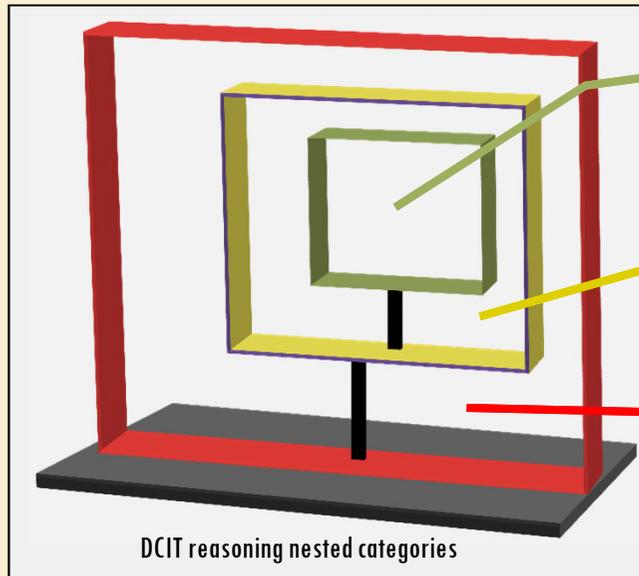


Besides the matching linkage and resulting order of the premises, the DCIT design requires that the SUBJECT of the first premise and the PREDICATE of the last premise in the line of reasoning form the justified or warranted CONCLUSION.



	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller...	... was considering bankruptcy.
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	...was under duress.
Therefore, CONCLUSION		
	The seller...	..was under duress.

A typical example of the property of TRANSITIVITY: A=B; B=C; So A=C. Membership is also TRANSITIVE.



The seller

A

was considering bankruptcy,
according to the broker

B

was actually considering
bankruptcy

C

DCIT reasoning nested categories

	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller...	... was considering bankruptcy, according to the broker.
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	... <u>was actually considering</u> <u>bankruptcy.</u>
	Therefore,	CONCLUSION
	The seller...	... <u>was actually considering</u> <u>bankruptcy.</u>

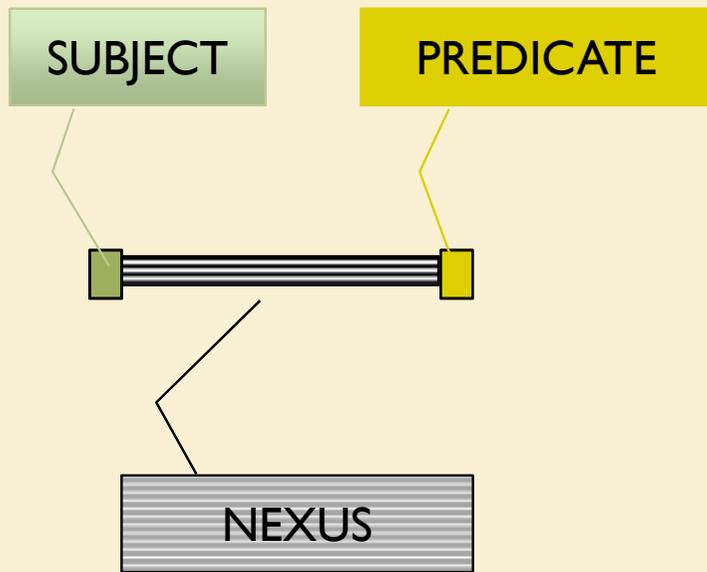
The process by which the DCIT line of reasoning justifies the conclusion (mode of inference) is called class-inclusion transitivity.

A belongs to (fits within) category B.

B belongs to (fits within) category C.

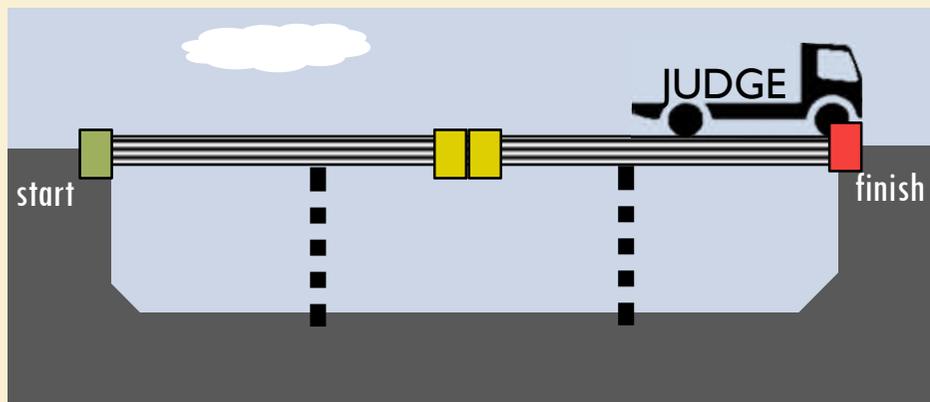
Therefore (through TRANSITIVITY)...

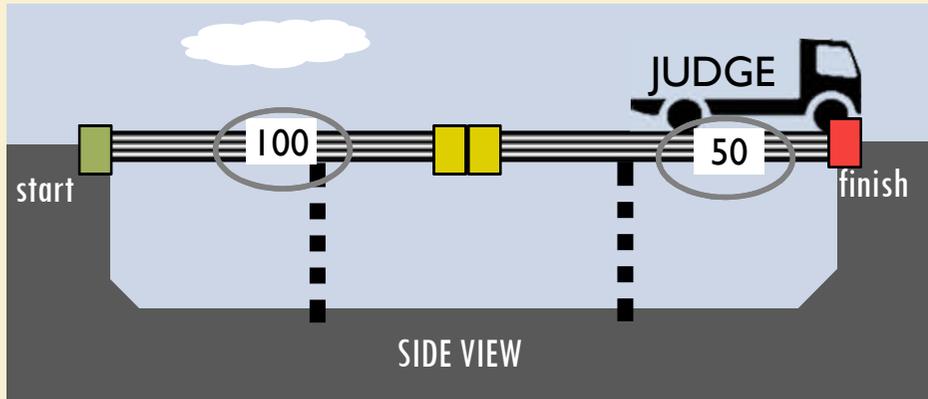
A belongs to (fits within) category C.



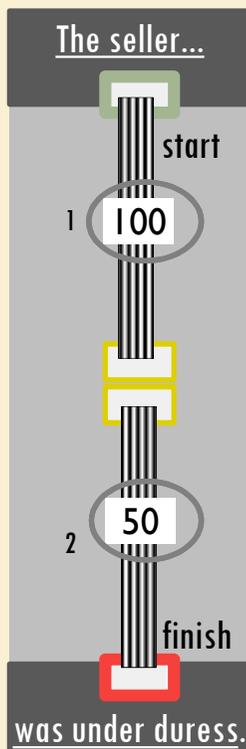
The NEXUS *span* between the SUBJECT and PREDICATE end-caps represents the relationship (i.e., single direction categorical) between the two parts of the sentence.

The strength of that relationship represents an individual's (e.g., judge's) perception of the level of certainty (e.g., believability, acceptability, or likelihood) of the truth of that premise formed by the connection of the SUBJECT and PREDICATE into a sentence.

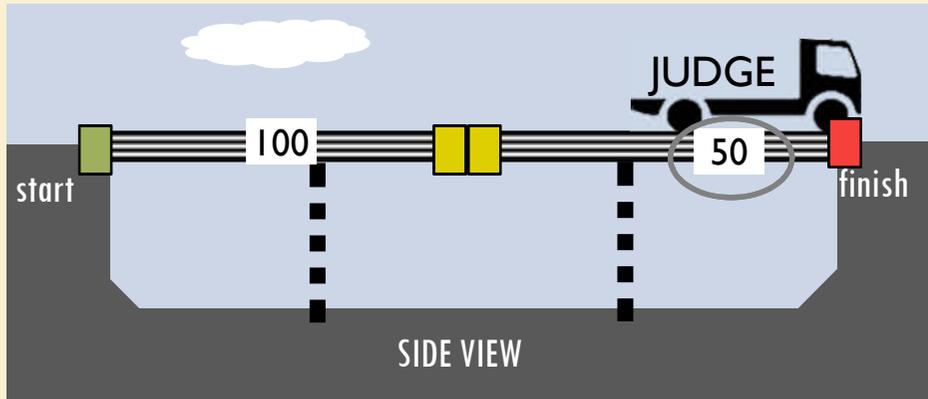




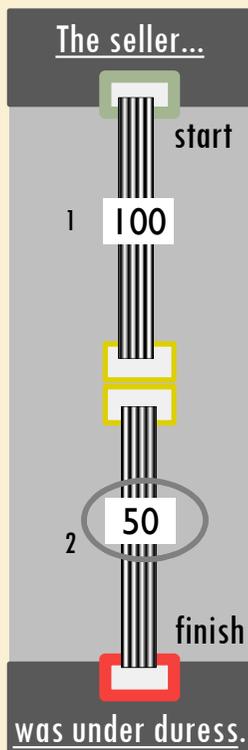
For example, assume the judge subjectively perceives the first premise having a 100% level of certainty of being true. But the second premise is perceived to have only a 50% level of certainty of being true.



	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller...	100 .. was considering bankruptcy.
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	50 ...was under duress.
	Therefore, CONCLUSION	
	The seller...	...was under duress.



A CONCLUSION justified from one line of reasoning (without objections) possesses only the smallest subjective level of certainty of truth (e.g., 50%) that is attached to one of the premises. So a CONCLUSION in this context can never be stronger than the weakest premise in the logical line of reasoning.



	SUBJECT COLUMN	PREDICATE COLUMN
1	The seller...	100 ... was considering bankruptcy.
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	50 ...was under duress.
	Therefore, CONCLUSION	
	The seller...	50 ...was under duress.

The appraiser's feeling of CERTITUDE may have **no relationship** to the judge's perception of CERTAINTY.

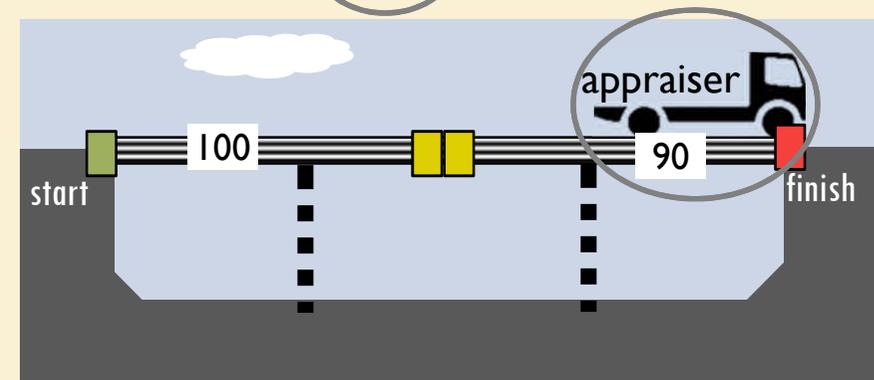
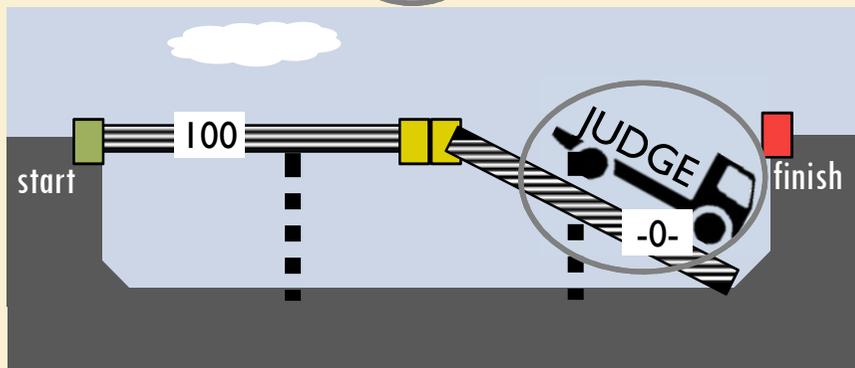
The amount of acceptability for any one PREMISE and for the justified CONCLUSION is a subjective judgment by each individual traveling the line of reasoning. So a CONCLUSION that seems absolutely certain to the appraiser may seem totally unbelievable to the judge.

JUDGE'S PERCEPTION

SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one day after it was listed for sale with the MLS..
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	0	...is not a reliable indication of its real market value.
Therefore, CONCLUSION			
	The sale of the house...	0	...is not a reliable indication of its real market value.

APPRAISER'S PERCEPTION

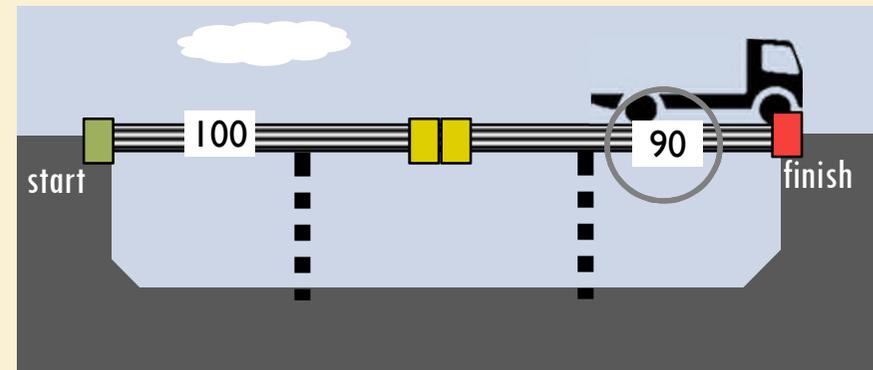
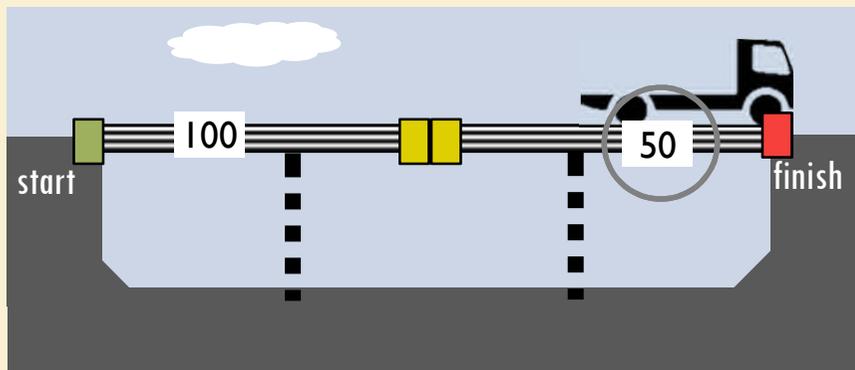
SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one day after it was listed for sale with the MLS..
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	90	...is not a reliable indication of its real market value.
Therefore, CONCLUSION			
	The sale of the house...	90	...is not a reliable indication of its real market value.



These examples illustrate the importance of using QUALIFIERS in possibly increasing the perceived level of certainty by the judge of the CONCLUSION. Examples of QUALIFIERS include the following: SOME, MANY, MOST, PROBABLY, LIKELY, POSSIBLY, GENERALLY etc.

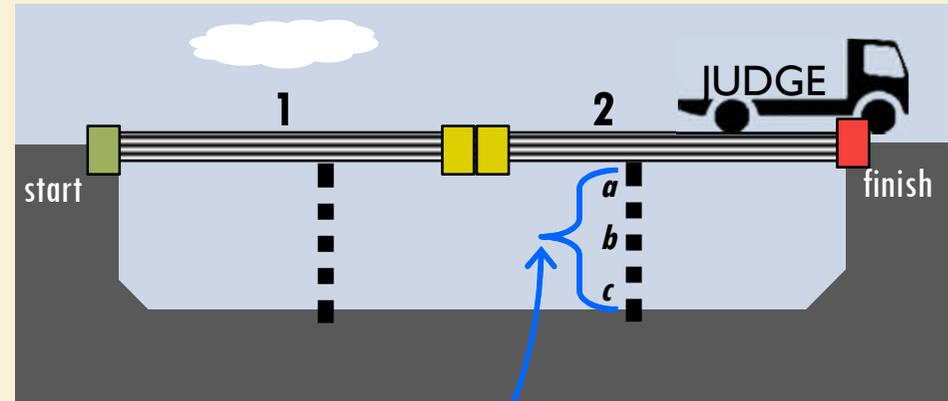
SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one year after the valuation date.
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	50	... MUST HAVE a market conditions adjustment.
Therefore, CONCLUSION			
	The sale of the house...	50	... MUST HAVE a market conditions adjustment.

SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one year after the valuation date.
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	90	... WILL LIKELY NEED a market conditions adjustment.
Therefore, CONCLUSION			
	The sale of the house...	90	... WILL LIKELY NEED a market conditions adjustment.



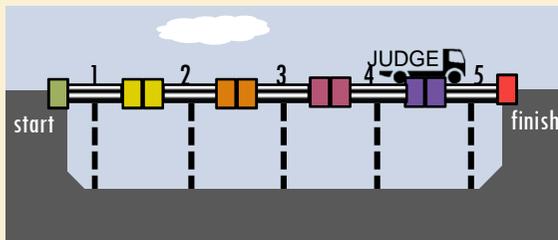
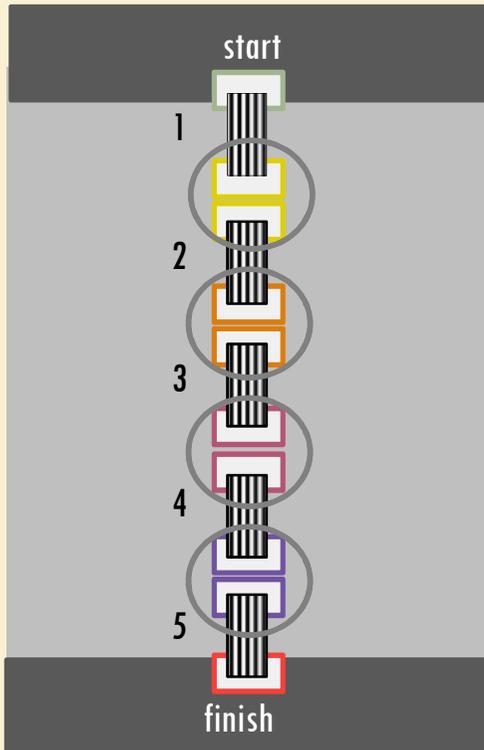
An ASSUMPTION provides necessary or ancillary support to the premise it supports.

There can be many assumptions supporting a premise. And the subjective level of certainty of the truth of a premise can be impacted by the level of certainty of any of its assumptions.



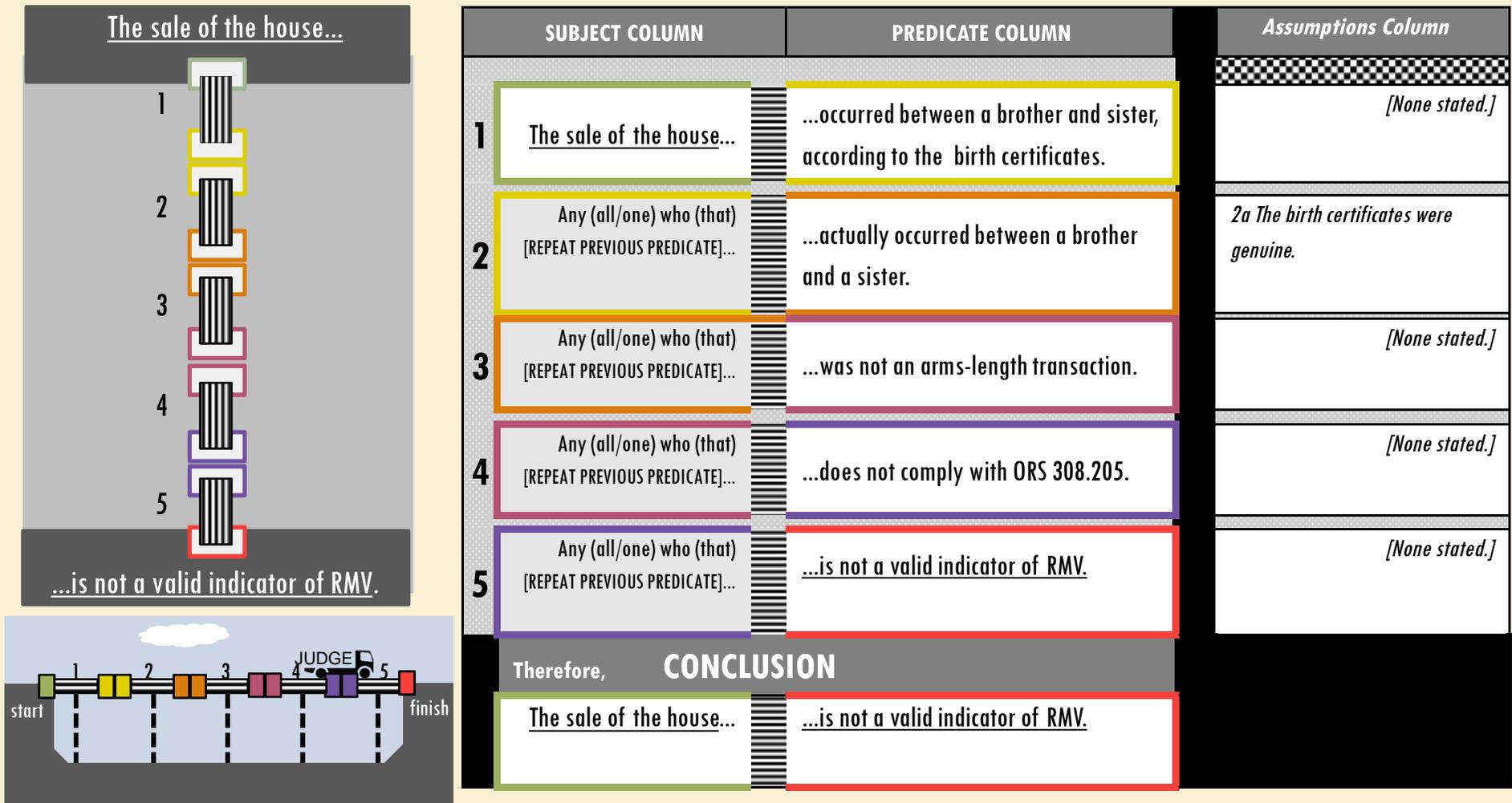
TOP		DOWN		
SUBJECT COLUMN		PREDICATE COLUMN		<i>Supporting Assumptions</i>
1	<u>The seller...</u>	... was considering bankruptcy, according to the broker.		<i>[None stated.]</i>
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	... <u>was actually considering bankruptcy.</u>		<i>2a The broker was in a position to know.</i> <i>2b The broker remembered correctly.</i> <i>2c The broker was unbiased.</i>
Therefore,		CONCLUSION		
	<u>The seller...</u>	... <u>was actually considering bankruptcy.</u>		

A line of reasoning can consist of multiple linkages rather than just one. These blank figures illustrate **four** matching linkages which connect five premises.



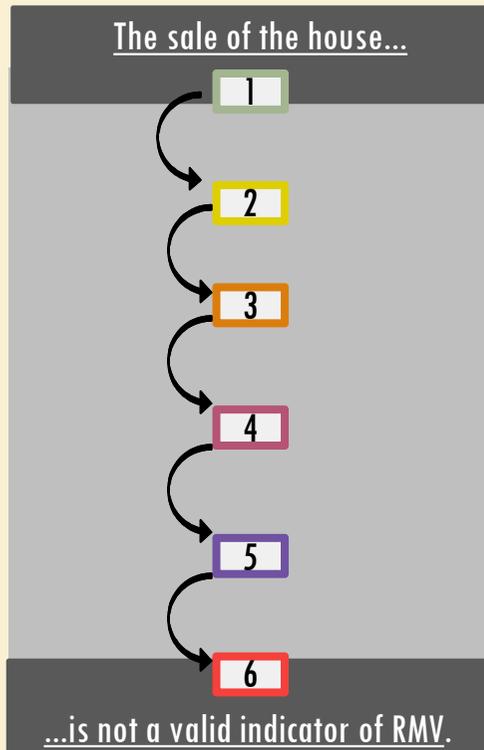
	SUBJECT COLUMN	PREDICATE COLUMN	Assumptions Column
1	SUBJECT OF CONCLUSION...	[...predicate of first premise.]	(A) [None stated.]
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	[...predicate of second premise.]	(A) [None stated.]
3	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	[...predicate of third premise.]	(A) [None stated.]
4	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	[...predicate of fourth premise.]	(A) [None stated.]
5	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	...PREDICATE OF CONCLUSION	(A) [None stated.]
	Therefore, CONCLUSION		
	SUBJECT OF CONCLUSION...	...PREDICATE OF CONCLUSION	

This example illustrates an actual line of reasoning with multiple linkages (inference steps).



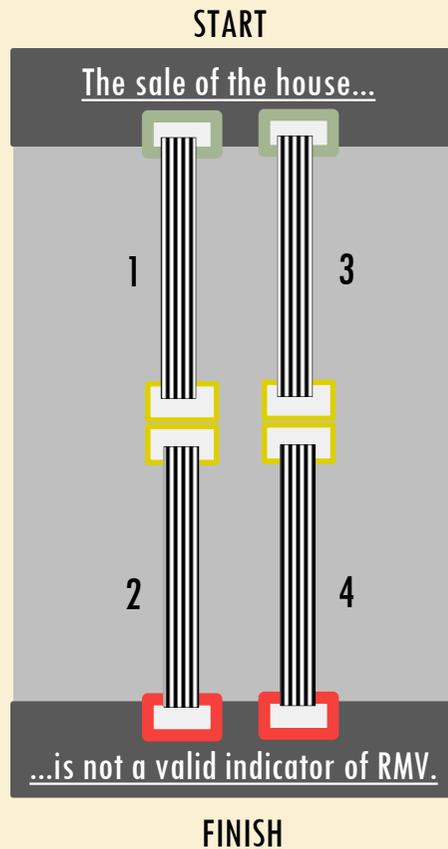
With familiarity using the DCIT structure, a line of reasoning can be seen as just connecting the dots (predicates).

Simplified, a line of reasoning is just connecting the dots of categorically nested PREDICATES.



SUBJECT COLUMN	PREDICATE COLUMN	Assumptions Column
1 <u>The sale of the house...</u>	2 ...occurred between a brother and sister, according to the birth certificates.	[None stated.]
	3 ...actually occurred between a brother and a sister.	2a The birth certificates were genuine.
	4 ...was not an arms-length transaction.	[None stated.]
	5 ...does not comply with ORS 308.205.	[None stated.]
	6 <u>...is not a valid indicator of RMV.</u>	[None stated.]
Therefore, CONCLUSION		
1 <u>The sale of the house...</u>	6 <u>...is not a valid indicator of RMV.</u>	

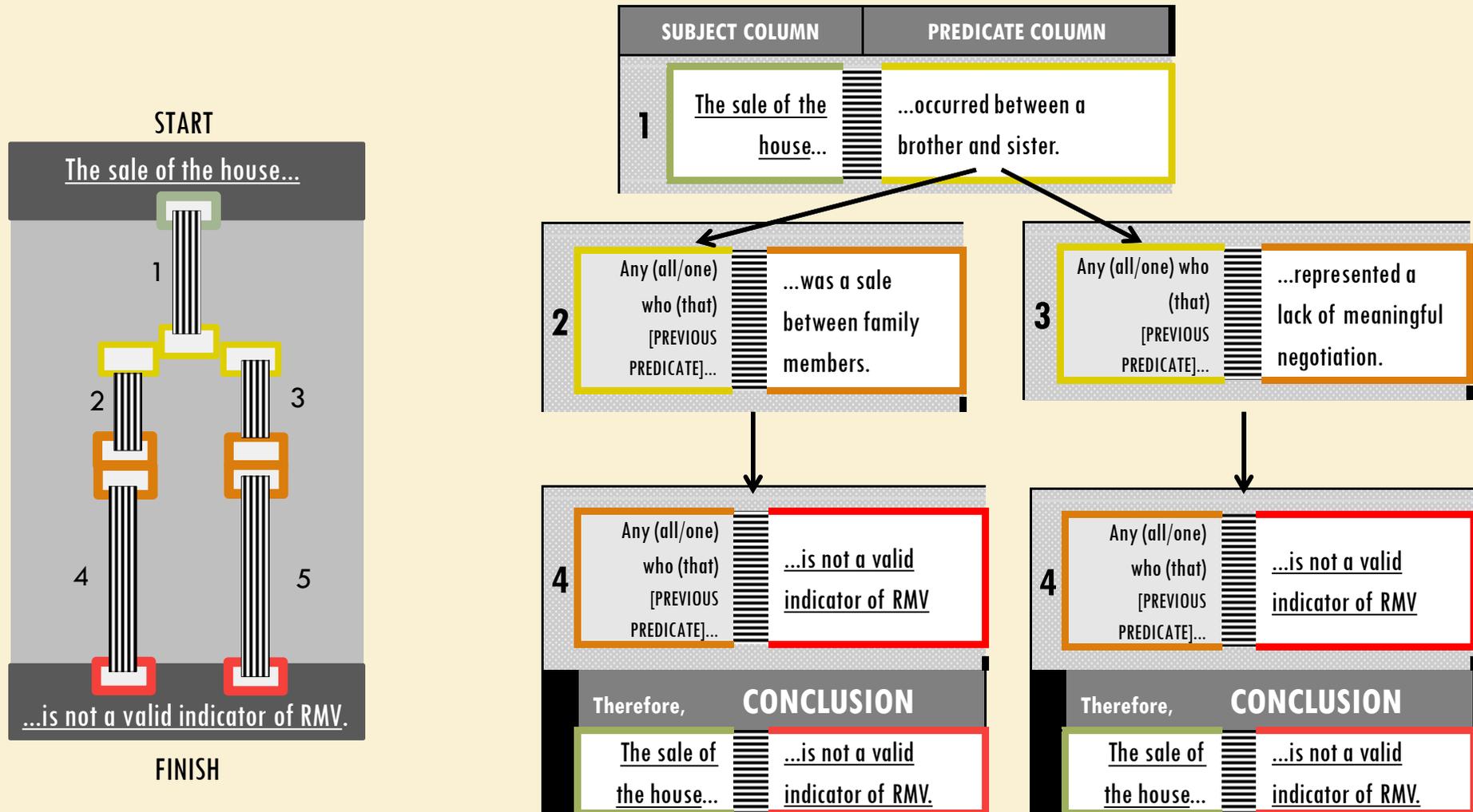
This example illustrates multiple (i.e., two) lines of reasoning justifying the same CONCLUSION. Multiple lines of reasoning may increase the subjective perception of the level of certainty of the CONCLUSION by the judge .



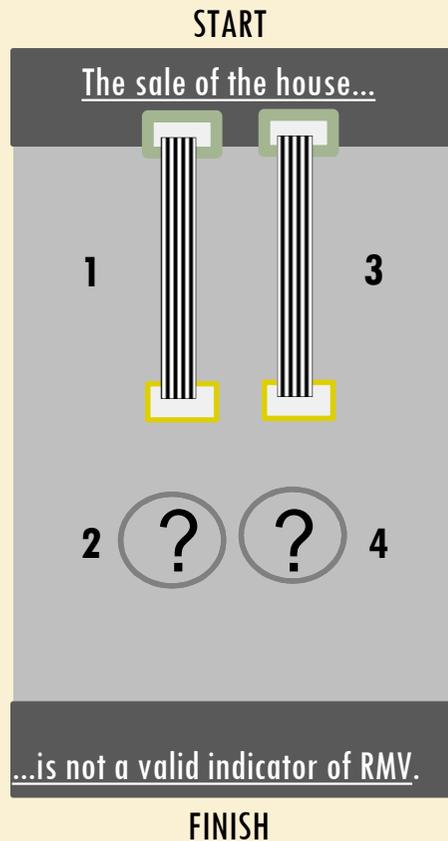
SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...		...occurred between a brother and sister.
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...		...is not a valid indicator of RMV
Therefore, CONCLUSION			
	The sale of the house...		...is not a valid indicator of RMV.

SUBJECT COLUMN		PREDICATE COLUMN	
3	The sale of the house...		...occurred ten years before the valuation date.
4	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...		...is not a valid indicator of RMV
Therefore, CONCLUSION			
	The sale of the house...		...is not a valid indicator of RMV.

This example illustrates (e.g., two) intra-lines of reasoning that branch from within the main line of reasoning that together justify the same CONCLUSION.



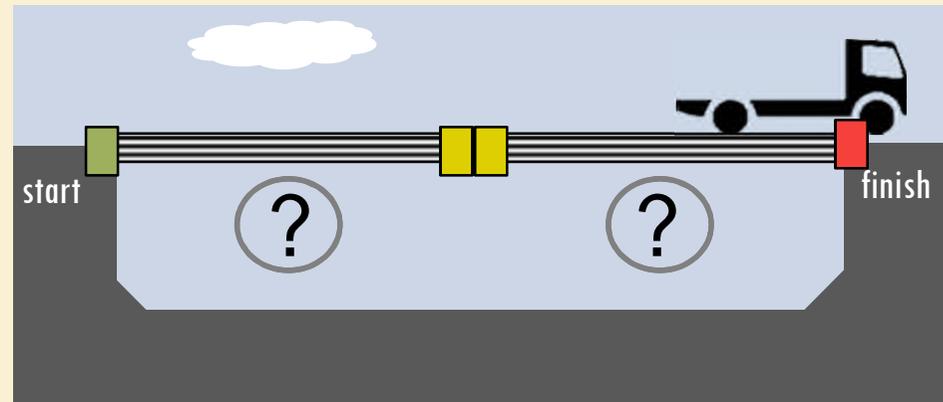
This example illustrates two separate lines of reasoning with each one missing one or more premises. Its appropriate use requires that the unstated premise(s) is obvious to the judge.



	SUBJECT COLUMN		PREDICATE COLUMN
1	<u>The sale of the house...</u>		...occurred between a brother and sister.
2	?		?
Therefore, CONCLUSION			
	<u>The sale of the house...</u>		...is not a valid indicator of RMV.

	SUBJECT COLUMN		PREDICATE COLUMN
3	<u>The sale of the house...</u>		...occurred ten years before the valuation date.
4	?		?
Therefore, CONCLUSION			
	<u>The sale of the house...</u>		...is not a valid indicator of RMV.

This example illustrates a line reasoning in which the ASSUMPTIONS are left unstated. While often this is an acceptable form, it does create the risk of an objection that the line of reasoning is conditional on other factors (e.g., the broker was in a position to know) that have yet to be proved.



	SUBJECT COLUMN	PREDICATE COLUMN	Supporting Assumptions
1	The seller...	... was considering bankruptcy, according to the broker.	?
2	Any (all/one) who (that) [PREVIOUS PREDICATE]	...was actually considering bankruptcy.	?
	Therefore,	CONCLUSION	
	The seller...	...was actually considering bankruptcy.	

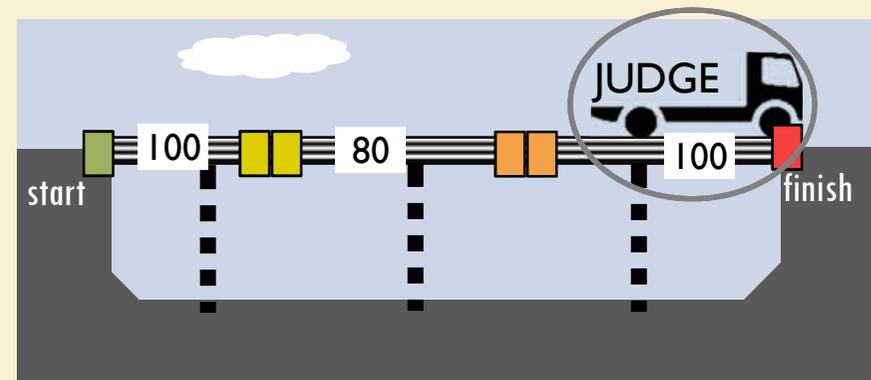
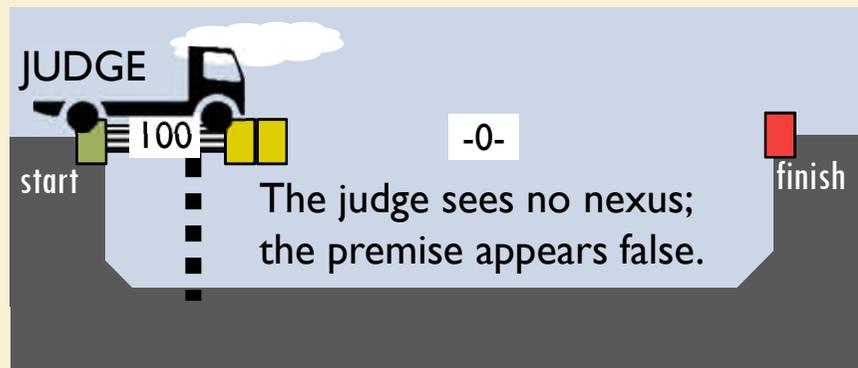
Making apparent all the inference steps at times can make the line of reasoning appear more certain.

The amount of acceptability perceived for a CONCLUSION can sometimes be increased by adding more linked premises so that there is not “too big a gap” for the judge to cross.

SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one day after it was listed for sale with the MLS.
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	0	...is not a reliable indication of its real market value.
Therefore, CONCLUSION			
	The sale of the house...	0	...is not a reliable indication of its real market value.

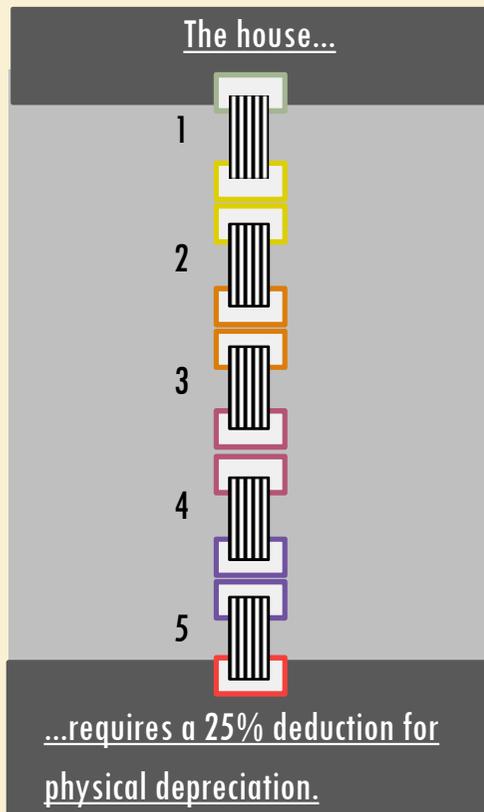
SHORTER GAPS/MORE LINKAGES

SUBJECT COLUMN		PREDICATE COLUMN	
1	The sale of the house...	100	...occurred one day after it was listed for sale with the MLS.
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	80	...was not marketed a sufficient length of time under the Rule.
5	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	100	...is not a reliable indication of its real market value.
Therefore, CONCLUSION			
	The sale of the house...	80	...is not a reliable indication of its real market value.



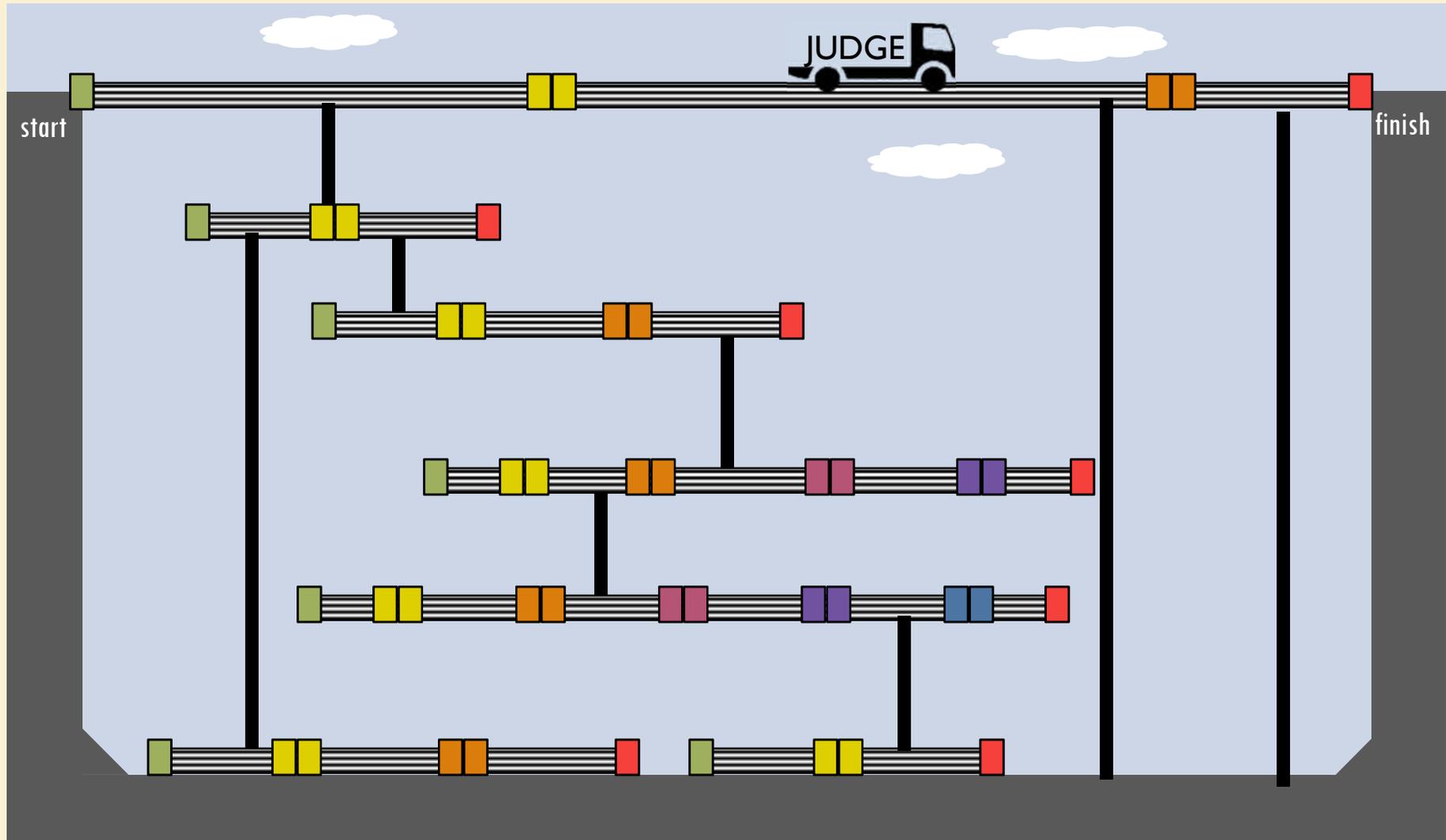
TOO BIG AN INFERENCE GAP

Too many premise linkages (piling inference upon inference) can be perceived as only weak speculation.



	SUBJECT COLUMN	PREDICATE COLUMN	Assumptions Column
1	The house...	...has a lawn that is six inches high.	[None stated.]
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	...has poorly maintained landscaping.	[None stated.]
3	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	...has overall poor maintenance.	[None stated.]
4	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	...is in poor condition.	[None stated.]
5	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	...requires a 25% deduction for physical depreciation.	[None stated.]
Therefore, CONCLUSION			
	The house...	...requires a 25% deduction for physical depreciation.	

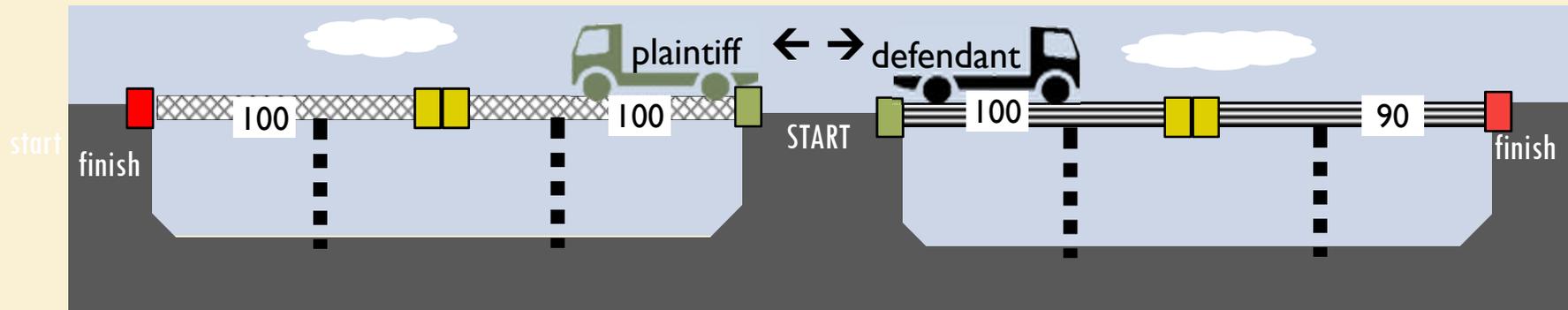
Just like a line of reasoning can have multiple premise linkages, a line of reasoning can also depend on multiple layers of ASSUMPTIONS with their own lines of reasoning support .



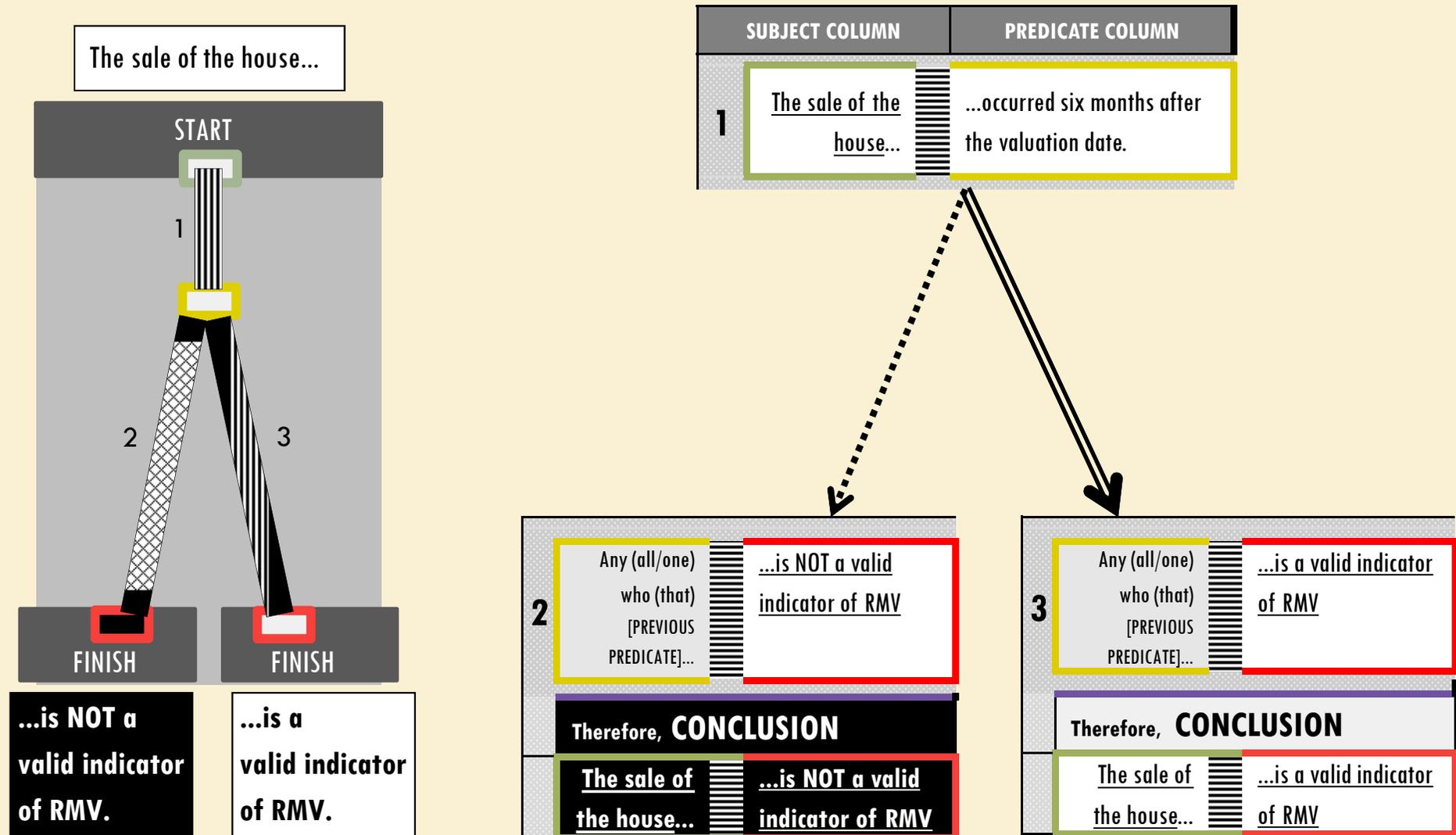
An OPPOSING attack provides the judge with an opposite CONCLUSION from the same starting point.

There are a number of possible types of attack against a logical line of reasoning. This type is an OPPOSING attack since it leads the judge in the opposing direction from the START.

PLAINTIFF			DEFENDANT		
	SUBJECT COLUMN	PREDICATE COLUMN		SUBJECT COLUMN	PREDICATE COLUMN
1	The sale of the subject house...	100 ...occurred one day after it was listed for sale with the MLS..	1	The sale of the subject house...	100 ...is generally the best indicator of real market value..
2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	0 ...is NOT a reliable indication of its real market value.	2	Any (all/one) who (that) [REPEAT PREVIOUS PREDICATE]...	90 ...is a reliable indication of its real market value.
Therefore, CONCLUSION			Therefore, CONCLUSION		
	The sale of the subject house...	0 ...is NOT a reliable indication of its real market value.		The sale of the subject house...	90 ...is a reliable indication of its real market value.



This is a **DIVERTING** type of attack since it attempts to divert the flow of acceptability within the original line of reasoning.

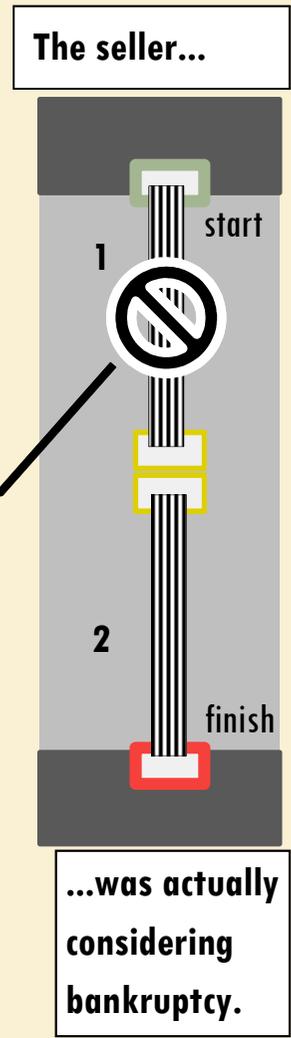


This is an **OBSTRUCTING** type of attack since it attempts to block the flow of acceptability within the original line of reasoning.

Examples:

The premise/assumption is:

- Inconsistent
- Ambiguous
- Vague
- Conditional
- False
- Weak
- Irrelevant
- Unsubstantiated
- Over generalized
- Not authoritative



Examples:

The line of reasoning is:

- Illogical
- Irrelevant
- Inconsistent
- Conditional
- Incomplete
- Weak
- Fallacious
- Piling inference upon inference

Assumption Sets are related to the Critical Questions that arise with “Argument Schemes” in academia.

Different defined ASSUMPTION SETS can accompany certain types of inference steps such as ones that depend upon **RELIABILITY OF A SOURCE**, **ANALOGY**, **SAMPLE GENERALIZING**.

SUBJECT COLUMN		PREDICATE COLUMN	Supporting Assumptions
1	<u>The house...</u>	... was well maintained, ACCORDING TO THE WITNESS.	<i>[None stated.]</i>
2	Any house that was well maintained ACCORDING TO THE WITNESS...	... <u>was well maintained.</u>	2a The Witness had personal knowledge (i.e., in a position to know). 2b The Witness focused his attention for a sufficient period of time. 2c The Witness had the necessary perceptual and cognitive capabilities. 2d The Witness had adequate memory capabilities. 2e The level of certainty of the Witness is sufficient. 2f The Witness is not personally biased. 2g The Witness intended to be truthful. 2h The Witness could make a rational inference of identification from the phenomena (sensory input) that the Witness actually perceived.
Therefore,		CONCLUSION	
	<u>The house...</u>	... <u>was well maintained.</u>	

Assumption Sets are related to the Critical Questions that arise with “Argument Schemes” in academia.

Different defined ASSUMPTION SETS can accompany certain types of inference steps such as ones that depend upon **RELIABILITY OF A SOURCE**, **ANALOGY**, **SAMPLE GENERALIZING**.

SUBJECT COLUMN		PREDICATE COLUMN	Supporting Assumptions
1	<u>The house...</u>	... needed structural repairs ACCORDING TO THE EXPERT.	[None stated.]
2	Any house that needed structural repairs ACCORDING TO THE EXPERT...	...needed structural repairs.	2a The Expert has sufficient qualifications and stature. 2b The Expert relied upon a theory or technique that has general acceptance in the scientific field of study. 2c The Expert made proper use of the theory or technique. 2d The error rate of the technique is acceptable. 2e The level of certainty of the Expert is sufficient. 2f The Expert is not personally biased. 2g The Expert intended to be truthful. 2h The Expert could make a rational inference of identification from the phenomena (sensory input) that the Expert actually perceived.
Therefore,		CONCLUSION	
	<u>The house...</u>	...needed structural repairs.	

Assumption Sets are related to the Critical Questions that arise with “Argument Schemes” in academia.

Different defined ASSUMPTION SETS can accompany certain types of inference steps such as ones that depend upon **RELIABILITY OF A SOURCE**, **ANALOGY**, **SAMPLE GENERALIZING**.

SUBJECT COLUMN		PREDICATE COLUMN	Supporting Assumptions
1	<u>The house...</u>	... needed structural repairs ACCORDING TO THE INSTRUMENT.	<i>[None stated.]</i>
2	Any house that needed structural repairs ACCORDING TO THE INSTRUMENT...	...needed structural repairs.	2a The Instrument was properly calibrated. 2b The Instrument was administered and read correctly. 2c The Instrument readings were recorded accurately. 2d The Instrument readings were not altered. 2e The Instrument readings are sufficiently probative.
Therefore,		CONCLUSION	
	<u>The house...</u>	...needed structural repairs.	

Assumption Sets are related to the Critical Questions that arise with “Argument Schemes” in academia.

Different defined ASSUMPTION SETS can accompany certain types of inference steps such as ones that depend upon RELIABILITY OF A SOURCE, **ANALOGY**, SAMPLE GENERALIZING.

SUBJECT COLUMN		PREDICATE COLUMN	Supporting Assumptions
1	<u>The house...</u>	... was similar in many respects to Sale No. 1.	[None stated.]
2	Any house that was similar in many respects to Sale No. 1...	...can, BY ANALOGY , be <u>valued based on the sales price of Sale No. 1.</u>	2a There are no critical differences sufficient to destroy the ANALOGY . 2b The similarities are defining characteristics of the comparable (SOURCE ANALOGUE). 2c There are a sufficient amount of similarities to give assurance that other characteristics are shared. 2d The shared characteristics are relevant to the inferred characteristic. 2e The characteristic in the conclusion is not inconsistent with the subject (TARGET ANALOGUE).
Therefore,		CONCLUSION	
	<u>The house...</u>	...can, by ANALOGY , be <u>valued based on the sales price of Sale No. 1.</u>	

Assumption Sets are related to the Critical Questions that arise with “Argument Schemes” in academia.

Different defined ASSUMPTION SETS can accompany certain types of inference steps such as ones that depend upon RELIABILITY OF SOURCE, ANALOGY, **SAMPLE GENERALIZING**.

SUBJECT COLUMN		PREDICATE COLUMN	Supporting Assumptions
1	The <u>sample of sales prices in the area...</u>	... indicates that housing prices are dropping by 10% per year.	[None stated.]
2	Any sample of sales prices in the area that indicates that housing prices are dropping by 10% per year...	...proves, by SAMPLE GENERALIZING , that <u>housing prices are actually dropping by 10% per year.</u>	2a. Any deviant examples in the SAMPLE are sufficiently accounted for in the reasoning structure. 2b The SAMPLE examples all belong to the same class. 2c The terms in the conclusion are common and defining characteristics of the SAMPLE examples. 2d There are enough facts to support the inference that all unknown relevant facts will support the same conclusion. (Adequate SAMPLE size) 2e The interval estimate is sufficiently small.
Therefore,		CONCLUSION	
	<u>The house...</u>	...proves, by SAMPLE GENERALIZING , that <u>housing prices are actually dropping by 10% per year.</u>	

SUBJECT COLUMN

PREDICATE COLUMN

Assumptions Column **35**

1

2

Any (all/one) who (that)
[REPEAT PREVIOUS PREDICATE]...

3

Any (all/one) who (that)
[REPEAT PREVIOUS PREDICATE]...

4

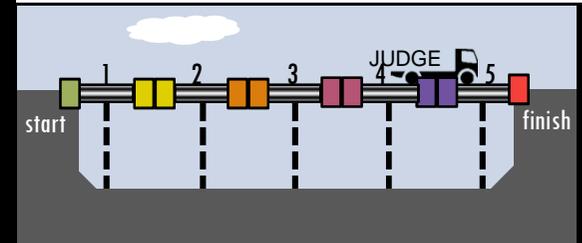
Any (all/one) who (that)
[REPEAT PREVIOUS PREDICATE]...

5

Any (all/one) who (that)
[REPEAT PREVIOUS PREDICATE]...

Therefore,

CONCLUSION



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