Taxonomy For Reasoning Questions Using Logic-Based Measurement

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Taxonomy for Logic-Based Measurement

Introduction

This taxonomy should be used as a blueprint for both developing and documenting tests of job-related thinking skills. The thinking skills presented in the taxonomy are the basic forms of deductive reasoning. These forms of reasoning are the building blocks of complex forms of reasoning, such as decision-making.

The basic forms of deductive reasoning are divided into four Parts for this taxonomy. Each Part covers a different area of the domain of deductive reasoning. Unlike other taxonomies, this taxonomy presents both correct and incorrect responses possible for each area of deductive reasoning, enabling the test developer to be as sure of the "incorrectness" of incorrect responses as the "correctness" of correct responses.

In all four Parts of the taxonomy, tables are given that first show a certain type of premise or certain types of premises and that provide the valid and invalid conclusions for the premise or premises shown. Part A covers reasoning from a single premise. The premise is a statement containing two sets. The conclusions in Part A are a single statement containing two sets. Part B covers reasoning from two premises. Each premise is a statement that contains two sets. The two premises have one set in common. The conclusions are a single statement containing two of the three sets in the premises. Part C covers reasoning with two statements that are connected. The emphasis in this Part is on how the statements are connected instead of the sets that comprise the connected statements. Part D covers reasoning with three connected statements. As in Part C, the emphasis in Part D is on how the statements are connected.

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Part A: Reasoning with Two Sets: Tables A, E, I, and O

In Part A, four tables are given showing the valid and invalid conclusions based on the four basic types of two-set premises. Each premise is a single statement containing two sets, and each conclusion is a single statement containing two sets. The first set of the premise is denoted by "S" and the second set is denoted by "P."

Table A: "all are"
One Premise with Two Sets and the Quantifier

A	Premise	All S are P.
A1	Valid Conclusion	No S are non-P.
A2		No non-P are S.
A3		Some P are S.
A4		All non-P are non-S.
A5	Invalid Conclusion	No S are P.
A6		Some S are not P.
A7		Some P are not S.
A8		All P are S.
A9		All S are non-P.
A10		All P are non-S.
A11		No P are S.

Table E: "no are "
One Premise with Two Sets

E	Premise	No S are P.
E1	Valid Conclusion	No P are S.
E2		All S are non-P.
E3		All P are non-S.
E4		Some P are not S.
E5	Invalid Conclusion	All S are P.
E6		All P are S.
E7		Some S are P.
E8		Some P are S.
E9		All non-S are P.
E10		All non-P are S.
E11		No non-P are non-S.

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Table I: "some are"
One Premise with Two Sets and the Quantifier

I	Premise	Some S are P.
I1	Valid Conclusion	Some P are S.
I2		Some P are not non-S.
I3		Some S are not non-P.
I4	Invalid Conclusion	All S are P.
I5		No S are P.
I6		Some S are not P.
I7		All P are S.
I8		No P are S.
I9		Some P are not S.

Table O: "some are not"
One Premise with Two Sets, the Quantifier

O	Premise	Some S are not P.
O1	Valid Conclusion	Some S are non-P.
O2		Some non-P are S.
O3	Invalid Conclusion	All S are P.
O4		No S are P.
O5		Some S are P.
O6		Some P are not S.
O7		No P are S.
O8		All P are S.

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Part B: Reasoning with Three Sets: Tables MA, ME, MI, and MO

In Part B, four tables are given showing the valid and invalid conclusions based on the four basic sets of conclusions for two-premise syllogisms. Each premise in a syllogism is a single statement containing two sets, and each conclusion is a single statement containing two sets. The two premises have one set in common, denoted by "M." The other two sets in the premises are denoted by "S" and by "P" as shown in the tables.

Table MA: Two Premises with Three Sets: S, M, and P

	Conclusions	
1	Valid Conclusion	All S are P.
2		No S are non-P.
3		No non-P are S.
4		Some P are S.
5		All non-P are non-S.
6	Invalid Conclusion	No S are P.
7		Some S are not P.
8		Some P are not S.
9		All P are S.
10		All S are non-P.
11		All P are non-S.
12		No P are S.

Name	Premises	Type	Logical Statement
1AA	Premise P	A	All M are P.
	Premise S	A	All S are M.

Table ME: Two Premises with Three Sets: S, M, and P

	Conclusions	
1	Valid Conclusion	No S are P.
2		No P are S.
3		All S are non-P.
4		All P are non-S.
5		Some P are not S.
6		Some S are not P.
7	Invalid Conclusion	All S are P.
8		All P are S.
9		Some S are P.
10		Some P are S.
11		All non-S are P.
12		All non-P are S.
13		No non-P are non-S.

Name	Premises	Type	Logical Statement
1EA	Premise P	E	No M are P.
	Premise S	A	All S are M.
2AE	Premise P	A	All P are M.
	Premise S	E	No S are M.
2EA	Premise P	E	No P are M.
	Premise S	A	All S are M.
4AE	Premise P	A	All P are M.
	Premise S	E	No M are S.

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Table MI: Two Premises with Three Sets: S, M, and P

	Conclusions	
1	Valid Conclusion	Some S are P.
2		Some P are S.
3		Some P are not non-S.
4		Some S are not non-P.
5	Invalid Conclusion	All S are P.
6		No S are P.
7		Some S are not P.
8		All P are S.
9		No P are S.
10		Some P are not S.

Name	Premises	Type	Logical Statement
1AI	Premise P	A	All M are P.
	Premise S	I	Some S are M.
3AA	Premise P	A	All M are P.
	Premise S	A	All M are S.
3AI	Premise P	A	All M are P.
	Premise S	I	Some M are S.
3IA	Premise P	I	Some M are P.
	Premise S	A	All M are S.
4IA	Premise P	I	Some P are M.
	Premise S	A	All M are S.

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Table MO: Two Premises with Three Sets: S, M, and P

	Conclusions	
1	Valid Conclusion	Some S are not P.
2		Some S are non-P.
3		Some non-P are S.
4	Invalid Conclusion	All S are P.
5		No S are P.
6		Some S are P.
7		Some P are not S.
8		No P are S.
9		All P are S.

Name	Premises	Type	Logical Statement
1EI	Premise P	E	No M are P.
	Premise S	I	Some S are M.
2AO	Premise P	A	All P are M.
	Premise S	O	Some S are not M.
2EI	Premise P	E	No P are M.
	Premise S	I	Some S are M.
2OA	Premise P	O	Some P are not M.
	Premise S	A	All S are M.
3EA	Premise P	E	No M are P.
	Premise S	A	All M are S.
3EI	Premise P	E	No M are P.
	Premise S	I	Some M are S.
3OA	Premise P	O	Some M are not P.
	Premise S	A	All M are S.
4EA	Premise P	E	No P are M.
	Premise S	A	All M are S.
4EI	Premise P	E	No P are M.
	Premise S	I	Some M are S.
4OA	Premise P	O	Some P are not M.
	Premise S	A	All M are S.

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Part C: Reasoning with Two Connected Statements: Tables R and S

In Part C, two tables are given showing the valid and invalid conclusions based on two basic types of connected statements. Each premise is a complex statement containing two statements, and each conclusion is complex statement containing two statements. The first statement of the premise is denoted by "p" and the second statement is denoted by "q."

The statements denoted by "p" and "q" can be the four basic two-set statements discussed in Parts A and B: All S are P, No S are P, Some S are P, and Some S are not P. If any of the four statements is used for "p" or "q," care must be taken in creating the negation of the statement. The following table shows the negation of the four basic statements.

Statement "p" (or "q")	**Negated statement "non-p" (or "non-q")**
All S are P	Some S are not P
No S are P	Some S are P
Some S are P	No S are P
Some S are not P	All S are P

Table S: Two Statements Connected; p and q

S	Premise	if p then q
S1	Valid Conclusion	if non-q, then non-p
S2		p only if q
S3		non-q only if non-p
S4	Invalid Conclusion	if non-p then non-q
S5		if q then p
S6		non-p only if non-q
S7		q only if p
S8		if p then non-q
S9		if non-q then p
S10		p only if non-q
S11		non-q only if p

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Table T: Two Statements Connected; p and q

T	Premise	p if and only if q
T1	Valid Conclusion	q if and only if p
T2		non-p if and only if non-q
T3		non-q if and only if non-p
T4		if non-q, then non-p
T5		p only if q
T6		non-q only if non-p
T7		if non-p then non-q
T8		if q then p
T9		non-p only if non-q
T10		q only if p
T11	Invalid Conclusion	p if and only if non-q
T12		non-p if and only if q
T13		q if and only if non-p
T14		non-q if and only if p
T15		if p then non-q
T16		if non-p then q
T17		if q then non-p
T18		if non-q then p
T19		p only if non-q
T20		non-p only if q
T21		q only if non-p
T22		non-q only if p

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Part D: Reasoning with Three Connected Statements: Table T

In Part D, a table is given showing the valid and invalid conclusions for a syllogism based two connected statements. Each premise is a complex statement containing two statements, and each conclusion is complex statement containing two statements. The two premises have one statement in common, denoted by "r." The other two statements in the premises are denoted by "p" and "q" as shown in the table.

Table RS: Three Statements Connected; p, q, and r

	Premise q	if r then q
	Premise p	if p then r
RS1	Valid Conclusion	if p then q
RS2		if non-q, then non-p
RS3		p only if q
RS4		non-q only if non-p
RS5	Invalid Conclusion	if non-p then non-q
RS6		if q then p
RS7		non-p only if non-q
RS8		q only if p
RS9		if p then non-q
RS10		if non-q then p
RS11		p only if non-q
RS12		non-q only if p