

## LEHMANN ON THE RULES OF THE INVALID SYLLOGISMS

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Anne Lehmann<sup>1</sup> makes a distinction between valid, invalid, and neither valid nor invalid syllogisms. A valid syllogism is one in which the conclusion must be true when each of the two premises is true; an invalid syllogism is one in which the conclusions must be false when each of the two premises is true; a neither valid nor invalid syllogism is one in which the conclusion either can be true or can be false when each of the two premises is true. An example of a valid syllogism is: All  $M$  is  $P$ , All  $S$  is  $M$ , All  $S$  is  $P$ ; an example of an invalid syllogism is: All  $M$  is  $P$ , Some  $S$  is  $M$ , No  $S$  is  $P$ ; an example of a neither valid nor invalid syllogism is: All  $P$  is  $M$ , All  $S$  is  $M$ , Some  $S$  is not  $P$ .

As you may know, the ' $S$ ' is called the minor term, the ' $P$ ' the major term, and the ' $M$ ' the middle term. The ' $S$ ' term must always appear in the second premise and conclusion, and the ' $P$ ' term in the first premise and conclusion. 'Some  $M$  is  $P$ ' and 'All  $S$  is  $P$ ' are called affirmative, and 'Some  $S$  is not  $P$ ' and 'No  $S$  is  $P$ ' negative. A term is either distributed or undistributed. If all is meant by a term, it is distributed, and if some is meant, it is undistributed; in All  $M$  is  $P$ , ' $M$ ' is distributed and ' $P$ ' undistributed; in No  $M$  is  $P$ , ' $M$ ' and ' $P$ ' are distributed; in Some  $S$  is  $P$ , ' $S$ ' and ' $P$ ' are undistributed; and in Some  $S$  is not  $P$ , ' $S$ ' is undistributed and ' $P$ ' is distributed (all  $P$  is not those some  $S$ ). There are 256 syllogisms. With Lehmann there are 24 valid syllogisms, 24 invalid, and 208 neither valid nor invalid. The valid and invalid syllogisms have the same set of premises, and their conclusions are contradictory to each other.

Those logicians who divide the 256 syllogisms into valid and invalid have come up with four rules, any one of which if violated by a syllogism means that the syllogism is invalid. Since Lehmann breaks up their invalid syllogisms into invalid and neither valid nor invalid, then if a syllogism violates one of the four rules it would not mean that it is invalid; it could be neither valid nor invalid. Therefore, she had to come up with rules of the

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1. Anne Lehmann, "Two sets of perfect syllogisms," *Notre Dame Journal of Formal Logic*, vol. XIV (1973), pp. 425-429.

invalid syllogisms. What I want to discuss is not the number of valid and invalid syllogisms she claims there are, but with the four rules of the invalid syllogisms that she comes up with.

First, I would like to say a word or two about the rules of the valid syllogisms which she quotes from a certain logic book. The four are: (1) Every valid syllogism has the middle term distributed at least once, (2) No term in the conclusion may be distributed unless also distributed in the premises, (3) No valid syllogism has two negative premises, (4) In a valid syllogism the conclusion may be negative if and only if one or the other premise is negative. The main thing that is wrong with these rules is that the first and third rules are descriptive and the second and fourth normative. Either all should be descriptive or all normative. The fourth rule should also be rephrased so as to reduce the risk of being counted as more than one rule. The rules rephrased descriptively are: (1) In each syllogism that is valid the middle term is distributed at least once, (2) In each syllogism that is valid the term when distributed in the conclusion is not undistributed in a premise, (3) In each syllogism that is valid there is at least one affirmative premise, (4) In each syllogism that is valid there is not exactly one negative statement.

Lehmann gives four rules of the invalid syllogisms. They are: (1) Every invalid syllogism has the middle term distributed at least once, (2) In an invalid syllogism no term is distributed in the conclusion and undistributed in the premises, (3) An invalid syllogism always has one and only one negative statement and exactly two affirmative statements, (4) One premise is negative only if the conclusion is affirmative; the conclusion is negative only when both premises are affirmative. One thing that is wrong with these rules is that the second rule is actually one of the four rules of the valid syllogisms. Another thing that is wrong is that the fourth rule can be deduced from the third rule. The rules should be: (1) In each syllogism that is invalid the middle term is distributed at least once, (2) In each syllogism that is invalid the minor term is distributed at least once, (3) In each syllogism that is invalid the major term is distributed at least once, (4) In each syllogism that is invalid there is exactly one negative statement.

Note that four is the minimum number and maximum number of rules in each of the two sets of rules. Note also that the logical structure is the same for each set—if a syllogism fits all four descriptions, then it is valid (invalid), and if it does not fit all four descriptions, then it is not valid (invalid).

We now have to draw up rules for the valid and invalid syllogism for the syllogism as constructed by Fred Sommers.<sup>2</sup> He adds negative terms (for example, non-*M*), and then assigns the arithmetical plus and minus to all terms to compute validity.

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2. Fred Sommers, "The calculus of terms," *Mind*, vol. 79 (1970), pp. 1-39.