ET

Logical Loop

Open Mathematics Collaboration*†

January 4, 2021

Abstract

We discuss the dubbed term ''logical loop'' and it's implication
regarding provability in undecidable theorems.

keywords: logic, provability, undecidable theorems, Gödel's incompleteness theorems

The most updated version of this paper is available at

https://osf.io/c5ezm/download

Introduction

1. T = tautology

2. C = contradiction

3. A, B = formulas

4. Let $A \overset{t}{\leftrightarrow} B$ be true only when both A and B are true.

5. $P \vdash Q$ means Q is derivable from P in the system.

---

*All *authors* with their *affiliations* appear at the end of this paper.

†Corresponding author: mplobo@uft.edu.br | **Open Mathematics Collaboration**

Self-Recursion and Equivalences

6. $A \equiv (A \leftrightarrow T)$

7. $A \equiv ((A \leftrightarrow T) \leftrightarrow T)$

8. $A \equiv (((A \leftrightarrow T) \leftrightarrow T) \leftrightarrow T)$

9. $A \equiv ((((A \leftrightarrow ...) \leftrightarrow T) \leftrightarrow T) \leftrightarrow T)$

10. $C \equiv (T \leftrightarrow C)$

11. $C \equiv (T \leftrightarrow (T \leftrightarrow C))$

12. $C \equiv (T \leftrightarrow (T \leftrightarrow (T \leftrightarrow C)))$

13. $C \equiv (T \leftrightarrow (T \leftrightarrow (T \leftrightarrow (... \leftrightarrow C))))$

14. $(A \equiv (A \leftrightarrow B)) \rightarrow (B \equiv T)$

Semigroup

15. semigroup = closed (A) + associative (B)

16. $\mathcal{S} \equiv (S$ is a semigroup$)$

17. $D \equiv (A \leftrightarrow B)$

18. $E \equiv (A \overset{t}{\leftrightarrow} B)$.

19. D does not prove (16) because both A and B can be false.

20. E proves (16) because both A and B are true.

21. Note that E is a particular case of D.

A proves B and B proves A

22. Let $L \equiv (A \vdash B \vdash A)$.

23. L stands for a *logical loop.*

24. Suppose L is true.

25. Does (24) prove (16)?

26. What is the difference between $A \leftrightarrow B$ and L?

Final Remarks

27. This paper is meant to be the first piece of argument towards solving this puzzle [1].

Open Invitation

Review, add content, and **co-author** this paper [2, 3].
Join the **Open Mathematics Collaboration**.
Send your contribution to `mplobo@uft.edu.br`.

Open Science

The **latex file** for this paper together with other *supplementary files* are available [4].

Ethical conduct of research

This original work was pre-registered under the OSF Preprints [5], please cite it accordingly [6]. This will ensure that researches are conducted with integrity and intellectual honesty at all times and by all means.

Acknowledgement

+ **Center for Open Science**
  https://cos.io

+ **Open Science Framework**
  https://osf.io

References

[1] Lobo, Matheus P. "Mathematics Beyond Axioms." *OSF Preprints*, 5 Sept. 2019. https://doi.org/10.31219/osf.io/adrjq

[2] Lobo, Matheus P. "Microarticles." *OSF Preprints*, 28 Oct. 2019. https://doi.org/10.31219/osf.io/ejrct

[3] Lobo, Matheus P. "Simple Guidelines for Authors: Open Journal of Mathematics and Physics." *OSF Preprints*, 15 Nov. 2019. https://doi.org/10.31219/osf.io/fk836

[4] Lobo, Matheus P. "Open Journal of Mathematics and Physics (OJMP)." *OSF*, 21 Apr. 2020. https://doi.org/10.17605/osf.io/6hzyp

[5] COS. *Open Science Framework*. https://osf.io

[6] Lobo, Matheus P. "Logical Loop." *OSF Preprints*, 22 July 2020. https://doi.org/10.31219/osf.io/c5ezm

The Open Mathematics Collaboration

Matheus Pereira Lobo (`lead author, mplobo@uft.edu.br`)[1,2]
`https://orcid.org/0000-0003-4554-1372`

[1]Federal University of Tocantins (Brazil)
[2]Universidade Aberta (UAb, Portugal)