GP - GEB Problem Set: The MIU-system

Nina Bonilla

Abstract: This problem set is based on Chapter 1 of Hofstadters GEB. In this chapter DRH presents his first Post Production System, the MIU-System.

The 25 Questions and Answers

1. What, does Hofstadter claim, is one of the most central notions running through GEB?

A formal system.

2. Who invented the sort of formal system that Hofstadter features in his book (the sort of system that the MIU-system exemplifies), and when did this invention take place?

Emil post invented the formal system mentioned in the 1920s.

3. In one four-word question, state the puzzle that is featured in this chapter.

Can you produce MU?

4. What is the given string in the MIU-system?

MI

5. What is the goal string of the MU-puzzle?

To change a string into another string.

6. How many rules in the MIU-system?

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7. Carefully, precisely, write down the first rule of the MIU-system, and give two examples of its use, one directly from the chapter, and one that does not appear explicitly in the chapter.

If you possess a string whose last letter is I, you can add on a U at the end. MI becomes MIU. II becomes MII becomes MIIU.

8. Carefully, precisely, write down the second rule of the MIU-system, and give two examples of its use, one directly from the chapter, and one that does not appear explicitly in the chapter.

Suppose you have Mx. Then you may add Mxx to your collection. MUM becomes MUMUM. MIU becomes MIUIU.

9. Carefully, precisely, write down the third rule of the MIU-system, and give two examples of its use, one directly from the chapter, and one that does not appear explicitly in the chapter.

If III occurs in one of the strings in your collection, you may make a new string with U in place of III. MIII becomes MU. MIIIMU becomes MUMU.

10. Carefully, precisely, write down the fourth rule of the MIU-system, and give two examples of its use, one directly from the chapter, and one that does not appear explicitly in the chapter.

If UU occurs inside one of your strings, you can drop it. UUU becomes U. MIUUU becomes MIU.

11. What is the word used to describe strings that are producible by the rules of a formal system from strings that have already been produced?

Theorems.

12. What is the technical term for the string MI in the MIU-system?

An Axiom.

13. In a formal system, is it more appropriate to say that theorems are proven or that theorems are produced?

They are produced.

14. How does Hofstadter define the term derivation?

It's an explicit, line by line demonstration of how to produce a theorem according to the rules of its formal system.

15. Reproduce, line by line, character by character (including "reasons" (rule citations)) Hofstadter's derivation of the string MUIIU.

(1) MI axiom

(2) MII from (1) by rule II

(3) MIII from (2) by rule II

(4) MIIIIU from (3) by rule I (

5) MUIU from (4) by rule III

(6) MUIUUIU from (5) by rule II

(7) MUIIU from (6) by rule IV

16. Write down, line by line (including "reasons" (rule citations)) a derivation of the string MIIUIIU.

Step 1: Apply every applicable rule to the axiom MI. This yields two new theorems MIU, MII. Step 2: Apply every applicable rule to the theorems produced in step 1. This yields three new theorems: MIIU, MIUIU, MIIII. The MU-puzzle 48 Step 3: Apply every applicable rule to the theorems produced in step 2. This yields five new theorems: MIIIIU, MIIUIIU, MIUIUIUIU, MIIIIIIII, MUI.

17. On page 37, Hofstadter claims that there is a fundamental difference between a machine and a human? What is that difference?

Machines can act unobservant, unlike humans.

18. With respect to formal systems, what is the difference between "working inside the system" and "working outside the system".

Working inside the system refers to using rules in a system to complete goals and working outside the system, refers to making reasonings about the system.

19. Are there any theorems in the MIU-system that do not start with the letter M?

20. How is the previous question answered, by working within the system or by working outside the system.

21. What does "M-mode" refer to? What does "I-mode" refer to?

Mechanic mode, Intelligent mode.

22. Do you think that humans can work in M-mode? Please defend your answer.

I believe that humans can work in m-mode, and often times do. Following a set of rules to complete a task repeatedly is a quality that both man and machine can possess.

23. Do you think that machines can work in I-mode? Please defend your answer.

I do not believe that machines can work in I-mode. Intelligence requires sentience, which is something that I do not believe, machines will ever be able to possess.

24. Two of the rules of the MIU-system are lengthening rules. What does this mean? Two of the rules of the MIU-system are shortening rules. What does this mean?

Lengthening rules allow you to increase the size of strings, while Shortening rules allow you to decrease the size of strings.

25. Define "decision procedure" with respect to a formal system.

A test which always terminate an infinite amount of time.