

Name: Amanda Pirie

Problem Set: The MIU-system

Abstract: This problem set is based on Chapter 1 of Hofstadter's 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?

Hofstadter claims that a formal system is one of the most central notions running through GEB.

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 and it took place in the 1920's.

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

The puzzle that is featured is, "Can you produce MU?"

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

The given string in the MIU system is MI.

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

The goal is to change one string into another.

6. How many rules are in the MIU system?

There are four rules.

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.

Rule number one states that if you possess a string whose last letter is I then you can add on a U at the end. For example, in the text, “MI and IM are two different strings” (Hofstadter 1979). Another example, from my brain, “MUI and IUM are two different strings.

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.

Rule number two states suppose you have Mx, then you may add Mxx to your collection. For example, in the text, “from MUM, you may get MUMUM” (Hofstadter 1979). Another example, from my brain, from MUU, where $x = uu$, so when the rule applies, you may get MUUUU(Mxx)

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.

Rule number three states that if there is a triple I string in a collection then a U can take place of the triple I. For example, in the text, “from UMIIIMU, you could make UMUMU” (Hofstadter 1979). Another example, from my brain, from MUIIIIMIIIIU, you could make MUUMUMUU,

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.

Rule number four states if there is a double U inside a string, it can be dropped. For example, in the text, “from UUU, get U” (Hofstadter 1979). Another example, from my understanding, from IIUUMUUIM, you’d get IIUMUIM.

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?

The word used to describe strings that are producible by the rules of a formal system from strings that have already been produced are theorems.

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

The term is axiom.

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

It is more appropriate to say that theorems are produced (/derived).

14. How does Hofstadter define the term derivation?

He defines it as a step-by-step demonstration of how the final theorem was produced, with explanations on the side from the rules of the 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) MUIIU	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.

(1) MI	axiom
(2) MII	from (1) rule II
(3) MIIU	from (2) by rule I
(4) MIIUIIU	from (3) by rule II

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

The difference between a machine and a human is that a machine overlooks the facts of what it is doing, whereas a human's consciousness makes it impossible for a human not to overlook those facts.

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

Working within the system refers to when you're not thinking about the system and you're just working with the rules of the system, whereas working outside the system refers to there being information or making observations without the rules.

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

Yes and no because although there wasn't a rule that stated a theorem had to begin with the letter M, the text did say that majority of the time the theorems would start with an M

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

Outside the system because there isn't necessarily a rule that says a theorem produced must start with an M.

21. What does “M-mode” refer to? What does “I-mode” refer to?

M-mode refers to the mechanic mode and I-mode refers to the Intelligent mode.

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

At first I thought no because a human couldn't become unobservant of their actions, nor could they start and complete a task without complaining or feeling bored. But then thinking about it, say a sociopath, who feels no empathy, murders someone... are their actions working in M-mode? It could be a survival mechanism for some people to have their mind go blank and have a machinic response to something specific.

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

Yes because machines can take intelligence from different places. Machines don't need to feel things in order to understand emotions.

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?

The first and second rules of the MIU system allow you to increase the size of strings, which is why it's called the "lengthening rules." The third and fourth rules allow you to somewhat shrink strings, which is why it's called the "shortening rules"

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

A decision procedure is a test for theoremhood that always terminates in a finite amount of time.