MIU PROBLEM SET #1

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

The idea of a 'formal system', or 'post production 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?

The American logician Emil Post 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?

"MU"

6. How many rules in the MIU-system?

4

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 may place a U on the end"**

Example #1: "MI -> MIU"

Example #2: "MIUUIUII -> MIUUIUIIU"

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.

If you have Mx, you may add Mxx to your collection, where x is a string.

Example #1 -> "MUM -> MUMUM"

Example #2 -> "MMM -> MMMMM"

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 appears in your collection you may replace it with U"

Example #1 -> "MIIII -> MUI or MIU"

Example #2 -> "UMUMUMIII -> UMUMUMU"

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 is in your string you may drop it"**

Example #1: "UUU -> U"

Example #2: "MUUUUUU" -> "MU"

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?

Theorem

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

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 they are produced.

14. How does Hofstadter define the term derivation?

A derivation of a theorem is an explicit, line-by-line demonstration of how to produce a theorem according to a formal system's rules.

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.

(1) MI - Axiom

(2) MII from (1) by 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 primary difference is that a computer can be unobservant, while a human is inherently observant.

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

Working inside the system is working within the rules of that system, working outside the system is working without being confined by those rules.

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

No.

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

Working outside the system, as outside the system is where analysis of that system takes place.

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

M-mode is mechanic mode, wherein you work solely within the system, as a machine would.

I-mode is intelligent mode, wherein you work outside of the system as a human would.

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

Humans can work in M-mode, as they are capable of replicating the thought of a machine. I did so in pursuit of solving the MU puzzle.

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

Machines can work in I-mode, although to my knowledge such a machine has not yet been built. To say machines cannot work in I-mode would necessitate proving that they are fundamentally incapable of doing so, which is not the case.

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 elongate the string. Shortening rules allow you to shorten the string.

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

A decision procedure is a theorem test that will produce an answer in a finite amount of time.