MIU-system Problem

This problem is from the GEB book. The idea is to use the four rules given to get an outcome of the string you want. The questions below are there to give a better understanding of how the MIU-system works. The MU problem is a major focus in this chapter as well.

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Questions/Answers

Q1: What, does Hofstadter claim, is one of the most central notions running through GEB?

- One of the most central notions in the book is that of a formal system.

Q2: Who invented the sort of formal system that Hofstadter features in the book (the sort of system that the MIU-system exemplifies) and when did this invention take place?

- Emil Post invented the sort of formal system used in the book in the 1920's, called the "Post Production System"

Q3: In one four-word question, state the puzzle that is featured in this chapter.

- Can you produce MU?

Q4: What is the given string in the MIU-system?

- The given string is "MI"

Q5: What is the goal string of the MU-puzzle?

- The goal string is "MU"

Q6: How many rules are in the MIU-system?

- There are 4 rules

Q7: 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: If you possess a string whose last letter is I, you can add on a U at the end.
- Ex1: MI -> MIU
- Ex2: MUUI -> MUUIU

Q8: 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: Suppose you have Mx, then you may add Mxx to your collection.
- Ex1: MIU -> MIUIU
- Ex2: MUIMUIUI -> MUIMUIUI

Q9: 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: if III occurs in one of the strings in your collection, you may make a new string with U in place of III.
- Ex1: MIIII -> MUI or MIU
- Ex2: MIUIUIII -> MIUIUU

Q10: 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: If UU occurs inside one of your strings, you can drop it.
- Ex1: UUU -> U
- Ex2: MIIUUIMIUUUI -> MIIUUIMII

Q11: 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

Q12: What is the technical term for the string MI in the MIU-system?

- Axiom

Q13: In a formal system, is it more appropriate to say that theorems are proven or that theorems are produced?

- Theorems are produced

Q14: How does Hofstadter define the term derivation?

- A derivation, in terms of a theorem, is an explicit, line-by-line demonstration of how to produce that theorem according to the rules of the formal system

Q15: Reproduce, line by line, character by character (including reasons (rule citation)) Hofstadter's derivation of the string MUIIU.

- 1 MI axiom
- 2 MII from 1 by rule 2
- 3 MIIII from 2 by rule 2
- 4 MIIIU from 3 by rule 1
- 5 MUIU from 4 by rule 3
- 6 MUIUUIU from 5 by rule 2
- 7 MUIIU from 6 by rule 4

Q16: Write down, line by line (including reasons (rule citation)) a derivation of the string MIIUIIU.

- 1 MI axiom
- 2 MII from 1 by rule 2
- 3 MIIII from 2 by rule 2
- 4 MIIIIIII from 3 by rule 2
- 5 MIIUIII from 4 by rule 3
- 6 MIIUIIIU from 5 by rule 1
- 7 MIIUUU from 6 by rule 3
- 8 MIIU from 7 by rule 4
- 9 MIIUIIU from 8 by rule 2

Q17: On page 37, Hofstadter claims that there is a fundamental difference between machine and human? What is the difference?

- It is impossible for humans to be unobservant where it is possible a machine is unobservant.

Q18: With respect to formal systems, what is the difference between working "inside the system" and working "outside the system"?

- Working inside the system you just worry about the process of what you are doing, outside of the system you are able to think about the issue and observe what you are trying to achieve.

Q19: Are there any theorems in the MIU-system that do not need to start with the letter M?

- All theorems must start with the letter M.

Q20: How is the previous question answered, by working within the system or by working outside the system?

- By working inside the theorem because it is a given that the system must start with the letter M

Q21: What does "M-mode" refer to? What does "I-mode" refer to?

- M-mode = mechanical mode
- I-mode = Intelligent mode

Q22: Do you think humans can work in M-mode?

- Yes, because we are able to do step by step procedures and other tasks without observing certain aspects.

Q23: Do you think machines can work in I-mode?

- No, because a computer cannot think 100% for itself, they are not as capable of picking up(observing) things as humans.

Q24: Two of the rules of the MIU-system are lengthening the system. What does this mean? Two of the rules are shortening rules. What does this mean?

- Rules 1 and 2 are lengthening rules, this means they allow you to add letters to the length of the string
- Rules 3 and 4 are shortening rules which means that the allow you to get rid of letters assuming they follow the rules.

Q25: Define "decision procedure" with respect to formal system.

- A test which always terminates in a finite amount of time, assuming the test is for theoremhood.