

MIU System Problem Set

1. What, does Hofstadter claim, is one of the most central notions running through GEB?
 - Hofstadter claims 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 sort of formal system that Hofstadter features in his book and it was invented in the 1920's.
3. In one four-word question, state the puzzle featured in this chapter.
 - "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 string of the MU puzzle is
6. How many rules in the MIU-system?
 - There are four rules in the MIU-system.
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 in explicitly in the chapter.
 - Rule I: "If you possess a string whose last letter is I, you can add on a U at the end."
 - An example of this from the chapter is "From IM, you may get IMU."
 - An example not explicitly from the chapter is: From MIMI, you may get MIMIU.
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 in explicitly in the chapter.
 - Rule II: "Suppose you have Mx. Then you may add Mxx to your collection."
 - An example of this from the chapter is "From MIU, you may get MIUIU."
 - An example not explicitly from the chapter is: From MMU, you may get MMUMU"
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 in explicitly in the chapter.

- Rule III: “If III occurs in one of the strings in your collection, you may make a new string with U in place of III.”
 - An example of this from the chapter is “From UMIIMU, you could make UMUMU.”
 - An example not explicitly from the chapter is: From UMIIIUMIIII, you could get UMUIIUMUII.
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 in explicitly in the chapter.
 - Rule IV: “If UU occurs inside one of your strings, you can drop it.”
 - An example of this from the chapter is “From MUUUIII, get MUIII.”
 - An example not explicitly from the chapter is: From MIMIUUU, you could get MIMIU.
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?
 - The technical term for the String MI in the MIU-system is Axiom.
13. In a formal system, is it more appropriate to say that theorems are *proven* or that theorems are *produced*?
 - Theorems are produced in a formal system because they “are merely strings of symbols.”
14. How does Hofstadter define the term derivation?
 - Hofstadter defines the term derivation as an explicit, line by line demonstration of how to produce that theorem according to the rules of the 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.
 - (1) MI Axiom
 - (2) MII From (1) by rule II
 - (3) MIII From (2) by rule II
 - (4) MIIIIIIII From (3) by rule II

- (5) MIIUIII From (4) by rule III
 - (6) MIIUIIIU From (5) by rule I
 - (7) MIIUUU From (6) by rule III
 - (8) MIIU From (7) by rule IV
 - (9) MIIUIIU From (8) 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?
- Hofstadter claims the difference is that it is possible for a machine to act unobservable, where it is impossible for a human to act unobservant.
18. With respect to formal systems, what is the difference between working “inside the system” and working “outside the system”.
- When you are working inside the system you can make observations about what your system is doing. When you are working outside the system you can step back and observe what you have already done and work back towards what your trying to complete.
19. Are there any theorems in the MIU-system that do not start with the letter M?
- No all the theorems in the MIU-system must start with M
20. How is the previous question answered, by working within the system or by working outside the system?
- Outside the system.
21. What does “M-mode” refer to? What does “I-mode” refer to?
- M-mode refers to mechanical mode
 - I-mode refers to intelligent mode
22. Do you think that humans can work in M-mode?
- Yes, because we can think for ourselves and we can perform tasks through our past experiences and observations.
23. Do you think that machines can work in I-mode?
- No, because a machine cannot think for itself, without a machines program it is relatively useless.
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 two rules of the MIU-system are lengthening rules. This allows you to increase the size of strings.
 - The second two rules of the MIU-system are shortening rules. This allows you to decrease the size of the string if it abides by the rules.
25. Define “decision procedure” with the respect to a formal system.
- A decision procedure is a test which always terminates in a finite amount of time. Determines if the system is a theorem.