Chapter 16

IAASL – Chapter 10: Gödel's Quintessential Strange Loop

These are questions for chapter 10 of Douglas Hofstadter's new book "I am a Strange Loop"

16.1 Gödel's Theorem

The purpose of this reading was to get an intuitive idea of the steps involved in the proof of Gödel's first incompleteness theorem. I will be following Hofstadter's presentation because I believe it is accessible and also does not betray the spirit of the proof. I cannot possibly provide Gödel's original proof in two hours, but I will provide references for further inquiry. Below are some references worth noting.

16.2 References

- "Gödel's Proof" by Ernest Nagel, James R. Newman — *This was the book which originally inspired Douglas Hofstadter. Very accessible.*

- "The Unknowable" by Gregory J. Chaitin. Accessible at `www.umcs.maine.edu/~chaitin /unknowable/` — *Chaitin is a remarkable mathematician and originator of algorithmic information theory. Here he implements a proof in LISP. Highly recommended. Appropriate for undergraduates.*

- "Gödel's Theorem: an Incomplete Guide to its Use and Abuse" by Torkel Franzèn — *A must buy for anyone wishing to cut the fat regarding the popularization of Gödel's incompleteness theorems. Good, but requires a little mathematics.*

- "Fundamentals of Mathematical Logic" by Peter G. Hinman — *I used this as a textbook for my Math Logic and Recursion Theory class as an undergrad. Not very friendly to the faint of heart, but mathematical precise and sweeping in its treatment. Has pretty much everything.*

16.3   Questions

1. Normally a tree springs from one seed. How do recursive sequences like the Fibonacci sequence spring from multiple seeds?

2. Create your own recursive sequence. Try varying the number of inputs, outputs, and rules of generation. Try graphing your sequence. Is it interesting?

3. In what realms do you think the following quote is applicable? *Where there's a pattern, there's a reason. (p. 127)*

4. What is the comparison of Euclid's *Elements* and Russell's *PM* to the Fibonacci sequence?

5. Why is it useful to be able to "shunt symbols and ignore meanings"?

6. What is the Mathematician's Credo?

7. What is the number associated with the statement "0=0" given by Hofstadter?

8. Why are there infinitely many primes? Why is this a good thing for Gödel?

9. What is a good way to establish whether or not a number is Fibonacci?

10. Define well-formed formula.

11. What is a good way to determine whether or not a number is a *wff* number?

12. How do we determine *prim*-ness?

13. What is a "Göru"?

14. How does Gödel use the statement "A certain integer g is not a prim number." to prove his theorem?

15. Google/Wikipedia "Fixed Point Theorems".

16. How does Quine's Quip resemble a fixed point.

17. What's the difference between Sluggo and Salt Girl?

Gödel, Escher, Bach: A Mental Space Odyssey
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