CSC356: Abstract machinery and Generative Processes

GEB Reading Assignment – MIU-system Problem Set

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1. **What is the formal system of Chapter 2 called?**

   This formal system is called the pa-system.

2. **What are the distinct symbols of this formal system?**

   The alphabet of this system contains 'p' 'q' and '-'.

3. **How many axioms in the pq-system?**

   There are infinitely many axioms in the pa-system.

4. **Write down the *axiom schema* for the pq system.**

   "xp-qx-"

5. **What is a "schema"? Define the term.**

   A schema is like a frame. It is a general pattern of fixed and variable features which can be used to classify and decompose an object.

6. **Wrtie down the three shortest axioms in the pq system.**

   The three shortest axioms are:

   (a) "p-q-"

   (b) "-p-q--"

   (c) "--p-q---"

7. **Write down the sole production rule of the pq system.**

   "Suppose x, y, and z all stand for particular strings containing only hyphens. And suppose that xpyqz is known to be a theorem. Then xpy-qz- is a theorem."

8. **Show that --p---q----- is a theorem of the pq-system. That is, derive it from an axiom and repeated application of the rule.**

   (1) --p-q--- axiom

   (2) --p--q---- from (1) by the only rule

   (3) --p---q----- from (2) by the only rule

9. **Show that -----p----q--------- is a theorem of the pa-system. That is, derive it from an axiom and repeated application of the rule.**

   (1) -----p-q------ axiom

   (2) -----p--q------- from (1) by the only rule

   (3) -----p---q-------- from (2) by the only rule

   (4) -----p----q--------- from (3) by the only rule

10. **Write down a string of symbols in the pq-system which is not well formed.**

    "-pq-q"

11. **State a decision procedure for the pq system.**

    If the string is a group of hyphens followed by a p followed by a group of hyphens followed by a q followed by a group of hyphens, and the length of the last group of hyphens is the sum of lengths of the first two groups of hyphens, then it is a well formed string.

12. **In the kindest paragraph on page 48, Hofstadter engages in some "top-down" reasoning. In one sentence, articulate exactly what it is that he demonstrates with his top-down reasoning in this paragraph?**

13. **In on sentence, characterize "top-down" reasoning.**

    Top down processing is characterized by using conceptual information to understand that behavior of basic rules.

14. **In on sentence, characterize "bottom-up" reasoning.**

    Bottom up reasoning is characterized by working with the most formal mechanical rules in order to discover their higher level properties.

15. **Consider the procedure for generating theorems of the pq system given at the top of page 49. What will be in the bucket after executing statements (1a) and (1b) and (2a) and (2b) and (3a) and (3b) – after all six of these statements have been executed!**

    -p-q--

    -p--q---

-p---q----

-p----q-----

--p-q---

--p--q----

--p---q-----

---p-q----

---p--q-----

16. **What role does the procedure introduced on top of page 49 play in Hofstadter's presentation of the pq system and related matters? Answer in one sentence!**

    This procedure represents a bottom up decision process.

17. **What is an *isomorphism*?**

    A mapping in the sense used in the chapter is a mapping between two complex structure with functional correspondences.

18. **What is an interpretation in the context of a formal system?**

    In this context and interpretation in a correspondence between symbols and words.

19. **When was linear B deciphered?**

    Linear B was deciphered in 1952.

20. **How many *meaningful* interpretations of the pq system did Hofstadter present in this chapter?**

    Two.

21. **How many meaningless presentations of the pq system are there?**

    Only one in the book.

22. **In 50 plus or minus 20 words, summarize what Hofstadter says in the section titled "Formal Systems and Reality"**

    First Hofstadter discusses the relationship between a formal system and its isomorphic domain. The two are causally independent, but they mimic one another. The author then goes on to ponder whether or not physical reality is a formal system itself.