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Cog 356

Pq- System problem set

- 1. What is the formal system of chapter 2 called?
  - a. The pq-system.
- 2. What are the distinct symbols of this formal system?
  - a. The distinct symbols are the letters p, q, and the hyphen.
- 3. How many axioms in the pq- system?
  - a. There is an infinite number of axioms in the pq-system.
- 4. Write down the axiom schema for the pq- system.
  - a. xp-qx
- 5. What is a "schema"? define the term.
  - a. The mold in which all axioms are cast.
- 6. Write down the three shortest axioms in the pq- system.
  - a. The 3 shortest axioms in the pq-system are:
    - i. -p-q--
    - ii. --p-q---
    - iii. ---p-q----
- 7. Write down the sole rule of production for the pq- system.
  - a. Rule- "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 the 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.
  - a. --p-q--- (axiom)
  - b. --p--q---- (from a)
  - c. --p---q----- (from b)
- 9. Show that -----p---q------ is a theorem of the pq- system. That is, derive it from an axiom and repeated application of the rule.
  - a. ---p-q----
  - b. ---p----q----- (From a)
  - c. -----p-----q------ (From b)
- 10. Write down a string of symbols in the pq- system which is not well formed.
  - a. --p--p----q---p-----
- 11. State a decision procedure for the pq- system.
  - a. The first two hyphen-groups should add up, in length, to the third hyphen group.
- 12. In the longest 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?
  - a. That you can hopefully work your way back to the source of all theorems by examining the system and steps using top-down reasoning. If you have lengthening rules you have a decision process

- 13. In one sentence, characterize "top-down" reasoning.
  - a. Working your way back towards the basics from something complex.
- 14. In one sentence, characterize "bottom-up" reasoning.
  - a. Working your way up from the basics to something more complex.
- 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!
  - a. -p-q--
  - b. -p-q-- -p--q---
  - с. -р-q-- -р--q--- --р-q---
- 16. What role does the procedure introduced on the top of page 49 play in Hofstadter's presentation of the pq-system and related matters? Answer in one sentence.
  - a. The main idea of the system to work up from the basics and to keep adding to the previous theorem. Due to the fact that there is a bottom up decision procedure.
- 17. What is an isomorphism?
  - a. When two complex structures can be mapped onto each other, in such a way that to each part of one structure there is a corresponding part in the other structure, and meaning is preserved.
- 18. What is an interpretation in the context of a formal system?
  - a. Interpretation in a formal system is symbol word correspondence.
- 19. When was Linear B deciphered?
  - a. Linear B was deciphered in 1953.
- 20. How many meaningful interpretations of the pq-system did Hofstadter present in this chapter.
  - a. There were 2 meaningful interpretations.
- 21. How many meaningless interpretations of the pq-system are there?
  - a. Infinite
- 22. In 50 plus or minus 20 words, summarize what Hofstadter says in the section titles "Formal Systems and Reality".
  - a. Reality could be a formal system because it has meaningless symbols that humans have given meaning to.