Part I - Relatively Short Answer

- 1. The main topical theme of this chapter is to understand how the jumbo program creates the jumbos. This is important because the jumbo program tries to capture how the human mind processes, assembles and transforms the sensory information that it tasks in.
- 2. The long term goal with jumble is to create a program that is able to assemble a bunch of letters together to form words, but in such a manner that it models how the human mind works.
- Herb Simmon would view this program as fruitless because for him it would be a waste of time to look at anything on the microsecond level, or underlying visual process. Furthermore, he believed that you should only try to capture things seen on the macrosecond level.
- 4. The core of the mystery is when the sensory information meet with the semantics of the word.
- 5. The concrete purpose is to imitate human skills used in the well known newspaper anagram.
- 6. Hofstadter describes his program as a building program because it takes atomic units, in this case it is letters, and then it constructs or gloms them together.
- 7. The serious purpose of jumbo is to model the mental processes of assembly and transformation.
- 8. The significance of the main task domain is to exemplify an extremely important facet of human intelligence the way that we mentally juggle many little pieces and tentatively combine them into various bigger pieces in an attempt to come up with novel things.
- 9. Hofstader suggests that in any type of perception that there is much back and fort motion that must occur. What he meant by this was the face that humans are able to look at something ambiguous and switch the different perspectives. This reveals that we need to see things wholly one way or wholly another way; the two versions don't mix together and stay mixed.
- 10. The analogies
 - a. Biological- the cell corresponds to the letters, and the very small molecules are referencing the tight bonds that are created, and would resemble the very tight consonant clusters. The amino acids are the less tightly bound consonant clusters. The amino acids act as complete words which can be can be bound or glommed together.
 - b. The basic anatomical unit, letters, is a human, and therefore, a tightly bound constanta cluster are two humans in a relationship. The idea is that a romantic bond takes time, so the first stage when they notice each other is representative of the bond forming. If that interaction is positive, then it goes to a spark which promotes exploration leading to a flash. A falsh is a mutual infatuation, but not resulting in a bond, the next state is casual dating, which is a genuine bond. The next step is romance and then marriage.
- 11. The nature of the parallelism is that it applies the same processing technique to multiple things at once. In the instance of Jumbo, this can be seen when the anatomical units,

letters of the alphabet, are forming into different conceptual chunks or gloms at the same time that another glom or chunk is being created.

- 12. Spark indicates two letter likelihood to be statistically prevalent with each other, or occur sometimes together, and it specifics the order in which it occurs. Affinity describes the levels of attraction that words can have, or the likeliness that the word would glom.
- 13. Codelets are how all processing in the jumbo occurs, each codelet or evaluation of a spark is given a number which indicates its urgency or weight to evaluate if the spark is good. It orders what pairs takes precedence, and therefore is the thing that determines what you see first in an ambiguous situation.
- 14. The thing that is the queue-like structure in which codelet are placed while waiting to be run is called a coderack.
- 15. Yes, the codelet is executed in a deterministic fashion by having fixed urgencies that were determined by the intrinsic affinities.
- 16. All processing in programs that adhere to Hofstadert's architecture is implemented via codelets because every letter has intrinsic affinities.
- Part 2 Very Short Answers
 - 1. When a codelet is run, it...
 - a. Is taken off the "queue"
 - b. Can cause changes to the "knowledge base"
 - c. May place follow-up codlets onto the "queue"
 - d. All of the above

Answer is D.

- The self- propagating nature of codelets enables lengthy processes to be carried out in small disjoint steps, each step setting up its own possible continuation. It resembles the way that long chains of chemical reactions can get carried out in independent small steps in the cell. TRUE
- 3. In Prolog, processing is carried out by means of rules which operate on the knowledge base. By analogy, in hofstadter's architecture, processing is carried out by codlets that operate on the CODERACK
- 4. Intelligence in programs that exploit Hofstadter's architecture, if indeed they have any, clearly has not been directly programmed; rather, it emerges as a statistical consequence of the way that many small program-fragments interact with each other. TRUE.
- 5. Intelligence in Jumbo and Copycat and other such programs is like a chess program that has a subtle tendency, but one that is crystal clear to sufficiently keen chess observers of "liking to get its queen out early" -- a tendency taking its programmers completely by surprise, as they never knowingly or explicitly put any such strategic concept into their program. TRUE
- 6. The phenomenon suggested in the previous question has been referred to as
 - a. An "innocently emergent" quality by Danniel Dennett

- b. "Epiphenomenon" by Doglas Hofstadter
- c. Both of the above.

ANSWER: C

- 7. Early in his discussion of Jumbo, Hofstadter indicates that its strategy is based on two analogies: which are they? (CHOOSE TWO)
 - a. The way that complex molecules are constructed inside a living cell (cellular biology).
 - b. The way that macroscopic order emerges naturally from the statistics o microscopic disorder (statistical mechanics).
 - c. The way that bonds of friendship are formed in a chaotic world (sociology)

ANSWER: A&C

- 8. Later on in his discussion of Jumbo, Hosfstadter indicates that a third anology is relavant to jumbo's strategy: Which is it?
 - a. The wahy that complex molecules are consturcted inside a living cell(cellular biology).
 - b. The way that macroscopic order emerges naturally from the statistics o microscopic disorder (statistical mechanics).
 - c. The way that bonds of friendship are formed in a chaotic world (sociology)

ANSWER: B

- According to Hofstadter, the reliable emergence of macro-laws from micro-chaos couold even be summarized in a metaphorical equation: *Thermo dynamics = statistical mechanics*. TRUE
- 10. The philosophy on which Hofstader's architecture is based goes against the grain of traditional AI work, which seeks to find explicit rules (not emergent or statistical ones governing the low of thoughts). TRUE
- 11. Hofstadter uses the term "thinkodynamics" to refer to laws governing thoughts at their own level. TRUE
- 12. Hofstadter uses the phrase "statistic mentalics" to refer to the laws governing subcognitive events that from the basis of higher-level thought. TRUE
- 13. What corny but (hopefully) catchy equation does hofstadter use to articulate his vision of the essential mission of AI should be in the future. "Thinkodynamics = statisical mentalics.
- 14. It was the first of Hofstadter's program to make clear use of the architecture with which he is so closely associated. What is its name. JUMBO
- 15. It is a parallel investigation of many possibilities to different levels of depth, quickly throwing out bad ones and homing in rapidly and accurately on good ones. PARALLEL TRACE SCAN
- 16. The idea articulated in the previous question was Hofstadter's, but much of it was already present in:

- a. GPS
- b. SOAR
- c. Hearsay II

Part 3 - More Relatively Short Answer

- 1. The thing that I found most interesting about codelets is that it allows a qualilia to become quantitative. The codelet describes the affiliation, but it also translates that affiliation into numerical data.
- 2. Something that interests me about a coderack is that it has the ability to be really well put together and organized, or it can become a jumbled mess. This is not directly referenced, but it can capture the importance of creating a solid knowledge based that is organized.
 - a. Parallel processing
 - b. Glomming
 - c. Parallel trace scan
 - d. Codelets / coderack
 - e. Modeling human cognition
 - f. Affiliation
 - g. Top down processing