Notes:

• The mean grade was 90.9%. (Impressive consistency with HW1!) Again, the most common reason for large deductions was lateness.

• This homework is worth 15% of your final grade.

• As a reminder, section attendance and participation is the single largest factor in your final grade.

A question-by-question grading key follows, with sample answers and graders’ comments on common pitfalls.

1. **(150 words or less; 15 points)** Below is a simple neural network, like those you discussed in your sections (each node has value 1 if its net input is at least 1, 0 otherwise).

   ![Neural Network Diagram]

   a. Assume that the possible inputs are 0 or 1 at each input node. What function does this network compute? (Note: you can give the customary name, or simply list the output for each possible input pair \((x,y)\), like in part (b).)

   b. In a few words — or, by drawing and including a picture — describe what you would have to change in this network to one that converts a different function: one that returns 1 if the inputs are both the same, 0 otherwise, like this. Note that you may have to change weights, thresholds, or both.

   
   \[(0,0) \rightarrow 1\]
   \[(0,1) \rightarrow 0\]
   \[(1,0) \rightarrow 0\]
   \[(1,1) \rightarrow 1\]

1
**Grading:** On part (a), 5 points for naming XOR or Exclusive Or. Otherwise, 1 point for each correct input-output pair, plus 1 point for correctly identifying all of the input-output pairs.

On part (b), 2.5 points for each correct input-output pair computed by the suggest neural network. Anytime a node or link was missing a value, the original value from the XOR neural network was assumed. For instance, if a student did not specify the output threshold, the output threshold was assumed to be 1. Anytime a student specified the weight of a node, it was interpreted as the weight of an outgoing link from that node.

**Sample Answers:** Part (a): XOR, exclusive “or”, or something else representing the input/output mapping

\[
\begin{align*}
(0,0) & \rightarrow 0 \\
(0,1) & \rightarrow 1 \\
(1,0) & \rightarrow 1 \\
(1,1) & \rightarrow 0
\end{align*}
\]

Part (b): many possibilities, e.g.

![Diagrams showing different network configurations](image)

**Common problems:**

- Part (1): naming “or” instead of “xor”, or saying \((1,1) \rightarrow 1\).
- Part 2: creating networks that only produced 0s or only 1s.
2. **(150 words or less; 15 points)** Imagine that you actually constructed a physical version of the network pictured above from 1(a) using electrical circuitry. Give a short description—it need not be very detailed at all—of what that object is doing at each of Marr’s levels.

**Grading:**
- Correctly explains computational level: 4 points
- Correctly explains algorithmic level: 4 points
- Correctly explains physical/implementation level: 4 points
- Clarity and readability: 3 points

**Sample Answer:** Marr’s computational level of analysis examines what a system does. To analyze the neural network in problem 1 at a computational level, we would say the network computes the XOR function. Using Marr’s algorithmic level of analysis, which addresses how a system computes outputs, we would say the neural network uses a combination of nodes, weights, and thresholds to process inputs into outputs. Lastly, at Marr’s physical level of analysis, we would say the neural network is implemented using electrical circuitry, a combination of transistors, wires, and circuit components.

**Common problems:**
- Failing to state that the neural network computed a function.
- Failing to mention any attributes of neural network (e.g. weights, nodes, thresholds).
- Failing to relate the neural network to Marr’s levels.
- Expressing the Physical level in a medium other than an electrical circuit (e.g. brain).
- Confusing Marr’s levels of analysis with Dennett’s stances.
- Expressing algorithmic level as something other than the neural network.
- Answer too vague.
3. **(150 words or less; 15 points)** For each of the following arguments, state whether the argument is valid. If it is, say why, and if it is not, say why not. Frame your answer using the language of *sets* as we did in class.

(1) All vegetarians are sailors.  
(2) Some sailors eat cheese.  
(3) So, some vegetarians eat cheese.

(1) Some nematodes do not crawl.  
(2) All green things crawl.  
(3) So, some nematodes are not green things.

**Grading:** For each syllogism,

- 2 pts. correctly state validity
- 3 pts. reasonable explanation
- 2 pts. explanation using language of sets (e.g. subset, superset, etc.)

Also, 1pt. if entire answer less than 150 words.

**Sample Answers:**

- Argument #1: Premise 1 states that the set of vegetarians is a subset of the set of sailors. Premise 2 states that the set of sailors and the set of cheese-eaters intersect. Because it is possible for the intersection of vegetarians and cheese-eaters to be null (i.e., no sailor is both a vegetarian and cheese-eater), the argument is invalid.

- Argument #2: Premise 1 states that the set of nematodes and the set of crawlers are not equivalent. Premise 2 states that the set of green things is a subset of the set of crawlers. Thus, because there exists nematodes outside the set of crawlers, and since all things that are green are in the set of crawlers, it must be the case that some nematodes are not green things. The argument is valid.

**Common problems:**

- Interpreting “some” in terms of subset rather than non-empty intersection
- Failure to interpret “not” as set complement (i.e., things that don’t crawl are the complement of the set of things that do crawl).
4. **(500 words or less; 25 points)** Re-read pp.27-45 of “Real Patterns” carefully, and answer the following questions in your own words.

i. What does Dennett mean by a “real” pattern?

ii. In discussing whether the “gliders” in the game of life “really exist”, Dennett says: “their salience as real things is considerable, but not guaranteed”. What does he mean by this?

iii. Dennett argues that folk psychology does describe real patterns, even though these patterns might not be patterns identifiable at the cellular level of the brain. In what sense are these patterns supposed to exist, if not at the level of the brain?

Grading:

- 5 points: Answer questions in own words (as opposed to just quoting)
- 5 points: Answer to the first question supported by text
- 5 points: Answer to the second question supported by text
- 5 points: Answer to the third question supported by text
- 5 points: Clarity

**Sample Answer and comments:**

Part I: What does Dennett mean by a “real” pattern?

Dennett offers an information-theoretic definition of a real pattern in a couple of places:

“A series is random if and only if the information required to describe the series is incompressible... A series is not random—has a pattern—if and only if there is some efficient way of describing it.” (page 32)

“A pattern exists in the data—is real—if there is a description of the data that is more efficient than the bit map, whether or not anyone can concoct it”. (page 34)

If your answer correctly expressed this idea, you should have gotten full credit. We also gave points if you did not get the information-theoretic definition, but instead captured both of the following points about real patterns: (1) that their existence is observer-independent and (2) that they can be used for making efficient predictions.

Model Answer:

“Dennett defines a real pattern as a method to describe information that is more efficient than a verbatim ‘bit map’ translation of the data. It is not necessary that someone concoct the description, just that a more efficient description exists.”

Part II: “Their salience as real things is considerable, but not guaranteed”

Dennett discusses this issue on page 40. We were looking for you to do two things in your answer. The first was to explain what Dennett means when he says that “gliders” (and other design-level configurations) have considerable salience as real things. The second was to explain what he means when he says that their salience is not guaranteed. A common
The mistake was to neglect to answer this second part of the question. To receive full credit, you had to answer both parts.

A common problem with answers was vagueness. If you just re-iterated in slightly different words that the gliders are considerably real, or that their realness is not guaranteed, we did not give full credit.

A common error was that a lot of people brought up the distinction between real motion and apparent motion to answer the second part of this question. That is, many people argued that the existence of gilders is not guaranteed because their movement is only apparent—that at the level of cells, nothing is “really” moving. This is a misunderstanding. Dennett is not a reductionist, and just because, at the physical level, everything is a toggling of cell states, does not mean that at the design level there is no genuine movement. What Dennett means when he says their salience is not guaranteed is that using gliders and other design-level constructs to make predictions for the game of life is not always going to be reliable or accurate. The salience is not guaranteed because the predictions are not guaranteed to work, and the predictions are not guaranteed to work because there can be noise to which the design level is not sensitive.

Model Answer:

There are two separate parts to this sentence. The first, “their salience as real things is considerable”, is answered by Dennett himself in the following line. He states that one can apply the larger ontological rules (the language of the design level) and predict, with some degree of risk, the future behavior of larger configurations of Conway’s Game of Life without bothering to compute the physical level (the individual cells in each frame). The second, “but not guaranteed”, refers to the “usually” or “provided nothing encroaches” clauses that Dennett uses to describe the considerations we must take for spare debris from earlier configurations. These exception cases are particularly attractive for Dennett’s mild realism because they incorporate his attitude of interpreting a pattern with some degree of noise: here, the pattern is the progressing configuration from frame to frame, viewed all at once as sequences of frames (such as the figures 2 and 3 in his essay), and the noise is the exception cases where things do not necessarily go according to plan. The reality (as defined above) of these laws of physics at the design level is thus questionably real, since the patterns they describe include some noise component.

Part III: In what sense are the patterns described by folk psychology supposed to exist?

This question is somewhat related to Marr’s levels. Folk psychological patterns for Dennett may not exist at the cellular level of the brain, but nevertheless they are discernible at higher levels. Typically, if you wrote that they exist at the level of human behavior, or the interpersonal level, or the level where the intentional stance is applicable, we gave full points.

A common mistake for this question was to directly quote Dennett’s position without showing that you really understand it yourself and can put it in your own words. Points were also taken off for particularly vague answers.

Model answer:
These patterns exist “as if by a hidden hand, an approximation of the ‘ideal’ order”. (43) Dennett provides the Conway’s Game of Life as an analogizing example to illustrate this point precisely. The design level of his analysis shows that an understanding of the overall ontology can be acquired without an application of the laws at the physical level. In the same way, although we may not be able to observe these patterns at the cellular level of the brain, if we adopt the appropriate (intentional) stance, we might be able to observe a larger image put together by a series of tiny processes that would otherwise appear to be minutaie. These patterns exist, as discussed in part i, if they can more efficiently summarize information than a bit-by-bit translation of the information. As such, if we are able to process our own ontology on remarks without demonstrating that the student understands the point Dennett is conveying.
5. **(500 words or less; 30 points)** Do you think folk psychology will continue to be useful for scientific psychology as we learn more about how the human brain works? Pick two of Fodor, Churchland, and Dennett, and anticipate how they might react to your claim.

**Grading:**

- 5 points: stating an opinion
- 5 points: justification for stated opinion
- 5 points: clarity
- 5 points: mentioning two authors
- 5 points: accurately representing author 1
- 5 points: accurately representing author 2

**Sample answer:** many possible, depending on the stated position and the interlocutors selected.

**Common problems:**

- lack of clarity
- getting Fodor mixed up with Churchland
- getting Fodor wrong. Fodor was a proponent of folk psychology — he said that neuroscience must and would confirm folk psychology because folk psychology is correct and real. If neuroscience failed to do this, then the neuroscience was wrong, not the other way around.
- saying that Churchland(s) don’t think folk psychology is useful at all. They don’t think it is defendable in the face of more rigorous, scientifically-founded theories, but they do accept that it is useful to people in their everyday lives. (I generally didn’t take any points off for this since it was usually a matter of overly strong language, but I think its worth clarifying)
- failure to attend to the fact that the question asks whether folk psychology will be useful to scientific psychology in the future, not just to people in general.
- not saying enough: this is a long answer response so we expected more than just a passing mention of different philosophers.