1. What is one key difference in the assumption of signal-detection theory and sequential probability ratio test?

SDT computes on a single piece of evidence, mapping it to a discrete category. SPRT on the other hand accounts for multiple pieces of evidence over time.

2. Consider Fig. 3C & 3D. Why does the data support the notion that S1 neurons encode sensory evidence, while neural response in the ventral premotor cortex reflect the final decision?

S1 neurons only respond when a stimulus is actually present. VPC neurons on the other hand continue to respond after the first stimulus is presented, and therefore carry information about that stimulus. Furthermore, these neurons respond differentially when the second stimulus is presented, signaling a decision.

3. Using the example of the random-dot coherent motion task (Fig. 5), identify the following elements of a decision: evidence, decision variable, priors, values, decision rule.

- **Evidence:** Amount of motion signal present in RDM stimulus; the activity level of upstream direction sensitive neurons.
- **Prior:** The monkey’s knowledge that there are only two directions to decide between; the direction the cell is tuned for.
- **Value:** The reward given for accurate decisions.
- **Decision Variable:** The cell’s activity as its firing rate increases, between 220ms after stimulus onset and until 70ms before the saccade is initiated.
- **Decision Rule:** The firing rate threshold that initiates a saccade.

4. Consider Fig. 5c. What two properties of the neural data in the figure indicates that neurons in the LIP do not only respond to the sensory properties of the motion stimuli, but actually reflect something of the final perceptual decision?

One property represented in the graph is that between 220ms after stimulus onset and until 70ms before the saccade is initiated (i.e. before the action indicating the decision) the neuron responds differentially to motion strength. For more difficult to discern motion the firing rate increases more slowly. A second property is found in the right most graph, which shows that in all cases when a decision is made, and it is associated with the cells receptive field, then the cell responds in exactly the same way, despite occurring at different times after stimulus onset.

5. Under what critical assumption is the overall evidence (cumulative log likelihood ratio) a sum of many additive terms, each representing the evidence (log likelihood ratio of each piece of sensory data) in each moment in time?

The overall evidence can be calculated as a sum only under the assumption that the individual pieces of sensory evidence are independent and identically distributed.
6. Consider the bounded random walk representation of the Sequential Probability Ratio Test in Fig. 2b. If the accuracy became more important than speed, in which direction(s) would you expect the decision bounds (A and A-), to shift? If speed became more important than accuracy, what would you then expect?

If accuracy is more important than speed, the decision bounds should be shifted further from the starting point, to give the SPRT more time to sample the space, and converge on the best decision. If speed is more important, then the bounds should be narrowed so that the process is more likely to encounter a boundary in fewer steps.

7. Why do the results related to Fig. 4 indicate that “information flow from sensory neurons to motor structures is more or less continuous”?

The trajectory of the eye during an evoked saccade, that took place while evidence was still being collected and before a decision was finally made, still deviated in the direction of the final choice. Thus information about the accumulating sensory evidence influences the motor neurons during the decision process, and not only after a decision is made when a motor action to signal that decision is initiated.