Questions-cum-Answer Sheet End-Sem Exam

NDM - PSY 307/507- Monsoon 2025

Scheme of Exam

17 Multiple Choice Questions (6 x 3 + 11 x 2 = 40 marks)
[marking scheme: correct (+2 OR +3); incorrect (0); un-attempted (0)

Total Time = 120 minutes

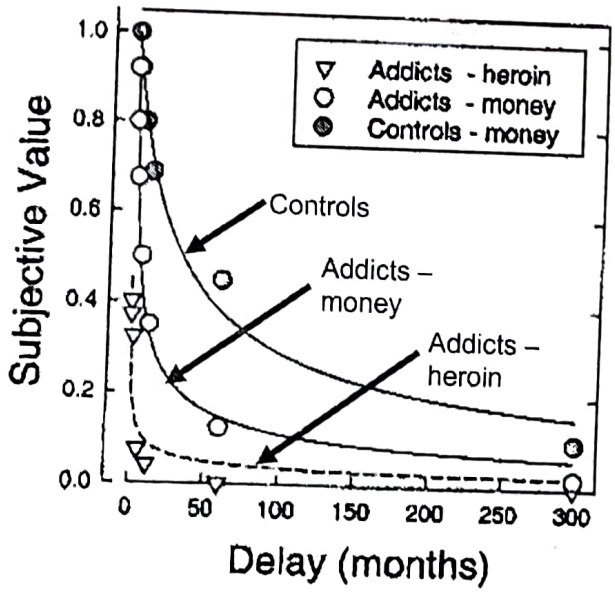
Roll Number
Name:

Multiple Choice Questions: Please INDICATE ANYONE most appropriate correct answer (option) from the available options to the following questions ONLY IN THE PRESCRIBED space marked 'Answer'. Marks for each question are mentioned in brackets ()

1. In a delay-discounting task, a participant chooses between "$26 now" and "$30 in 15 days," and their choices are modelled using the below hyperbolic discounting equation

$SV = \frac{A}{1+kD}$ (equation 1)

where SV = subjective value, A = amount of delayed award, k = discount rate, D = delay in months



The figure shows that heroin-addicted individuals show a much steeper discounting curve compared to controls.

Which of the following sets of inferences is most consistent with the task structure AND the hyperbolic model given in equation 1? (3 Marks)

Answer:

A. If a participant consistently chooses the immediate reward ($26 now), their inferred subjective value of delayed rewards decreases more rapidly with increasing D, implying a larger k, and their discounting curve should resemble the controls-money curve shown in the figure.

B. A participant with a very small k would evaluate $30 in 15 days as almost equal in subjective value to $26 now, suggesting that they show extreme impulsivity and would fit the addicts-heroin curve in the figure.

C. If a participant's choices match the delayed option in short delays but switch to the immediate option at longer delays, the discount rate (k) would be high and resemble the addicts-money curve.

D A participant whose subjective value remains high even for long delays must have a low discount rate (small k), generating a shallow hyperbolic curve, and would most likely resemble the controls-money curve.

2. Participant Z performed a risky-choice task with two versions of the same choice:

- **Gain frame:** *"You will definitely save 200 people OR you can take a risk with a 1/3 chance of saving all 600 people."*
- **Loss frame:** *"You will definitely lose 400 people OR you can take a risk with a 1/3 chance that no one will die."*

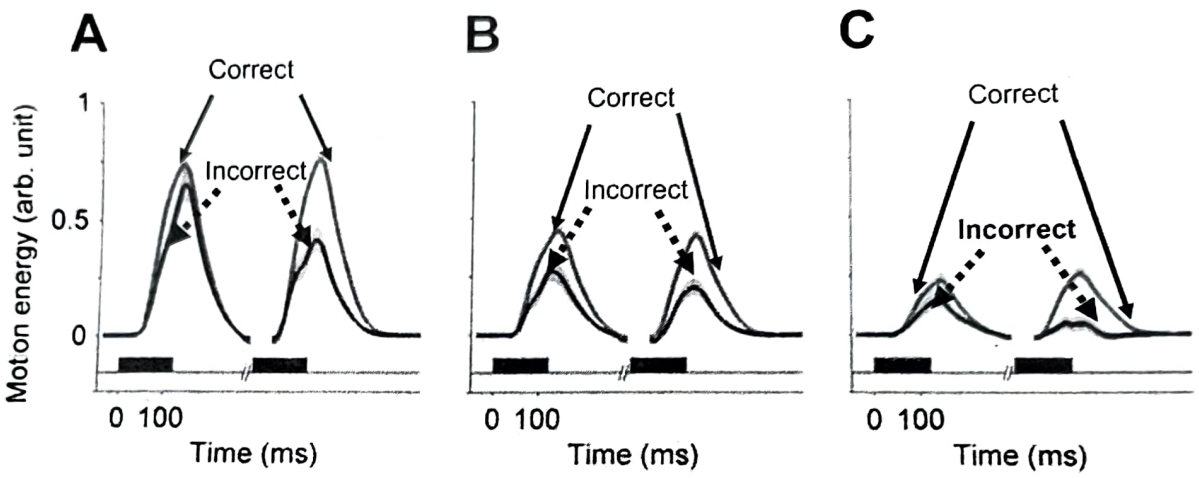
Even though the options are mathematically identical, Participant Z consistently chooses the risk-averse option in the gain frame and the risk-seeking option in the loss frame. The fMRI data show low orbitofrontal cortex (OFC) activity during these decisions, with stronger recruitment of emotional valuation region. Based on this information, which of the following conclusion(s) are supported? (2 marks)

Answer:

A. Participant Z's rationality index would be likely low as there is positive correlation between OFC activation and rationality index.
B. Reduced OFC engagement results in impaired integration of value across frames.
C. Low OFC activation results in Participant Z to rely more on pleasure-driven outcomes.
D. Participant Z's fMRI activity demonstrates normatively optimal decision-making, as the expected value of the risky option is higher in both frames.
E. Participant Z's preferences were driven by anterior cingulate cortex-driven valuation than OFC-based value integration.
F. Participant Z's preferences were driven by nucleus accumbens-driven valuation than OFC-based value integration.
G. Participant Z's rationality index would be optimal as evidence through fMRI data
H. A and B
I. A, B, and E
J. B and E
K. D and F
L. D, E, and G
M. None of the above

3. The figure shows motion-energy time courses for double-pulse random-dot motion stimuli at three coherence levels (A: 12.8%, B: 6.4%, C: 3.2%). Each pulse provides a brief burst of motion information. The horizontal bars shown in the figure represent temporal gap between each pulse. For each coherence condition, the curve labelled *Correct* (marked with solid lines) represents the average motion-energy waveform for trial (plotted along on y-axis) in which the participant chose the correct direction and curve labelled *Incorrect* represents the average motion-energy waveform for trial (plotted along on y-axis) in which the participant chose the incorrect direction. Which behavioural phenomenon best explains why the second pulse has greater influence on correct choices? (2 marks)

Answer:

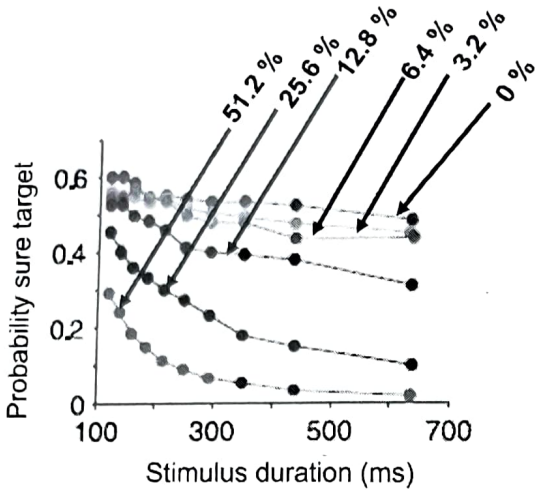


A. Leaky accumulation
B. Primacy effect
C. Recency effect
D. Both A and B
E. Both A and C
F. None of the above

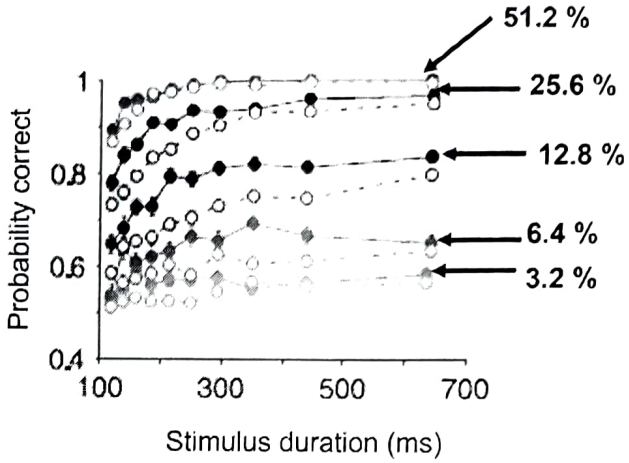
4. A decision maker made perceptual decisions about the net direction of motion in a dynamic random-dot display with varying coherence levels – 0 %, 3.2 %, 6.4 %, 12.8 %, 25.6 %, and 51.2 %. The duration of motion coherence was varied. The decision maker was also provided the option to abort the direction discrimination and to choose instead "sure target" - a small but certain reward. This "sure target" was shown after the motion stimulus ended and before the decision maker made a choice. The figure A shows the probability of choosing the "sure target" along y-axis and stimulus duration along x-axis for different coherence levels. The solid lines along with solid markers in figure B show decision accuracy on trials in which the decision maker chose not to take the sure target and instead made a direction decision. The decision accuracy is plotted along y-axis and stimulus duration along x-axis for different coherence levels. Which interpretation best explains why confidence (sure-target choices) and accuracy diverge as stimulus duration increases in this particular setup? (2 marks)

Answer:

A.



B.



A. The decision maker becomes less sure with longer stimulus duration because long trials are confusing due to leaky evidence accumulation, which affects both confidence and accuracy.
B. Longer viewing times affect both confidence and accuracy in the same way, so the divergence must be random noise.
C. Confidence and accuracy are identical processes, so any differences arise only from attention lapses.
D. Confidence and accuracy come from different brain regions that do not interact.
E. Confidence is based on how strong the motion feels early in the trial, but accuracy improves as more evidence accumulates over time.

5. In a behavioural experiment, Anita and Lata each received a surprise financial windfall of Rs.1,000. In one scenario involving potential gain, they are given the following options:
Option A: Invest in mutual funds with a guaranteed additional gain of Rs.400.
Option B: Take part in a gamble with a 50% chance to gain an additional Rs.1,000 and a 50% chance to gain nothing.

In a second scenario involving a potential loss, they are given the following options:
Option C: Invest in mutual funds with a guaranteed loss of Rs.400.
Option D: Take part in a gamble which has a 50% chance to lose Rs.1,000 and a 50% chance to lose nothing.

As per Prospect Theory, which of the following outcomes is most likely? (3 marks)

Answer:

A. Anita and Lata will both choose Option A for the gain and Option C for the loss because people prefer certainty in both gains and losses.
B. Anita and Lata will both choose Option B for the gain and Option D for the loss because people generally prefer gambles in both situations.
C. Anita will likely choose Option A for the gain and Option C for the loss if she is risk aversive, while Lata, if feeling more risk-tolerant, may choose Option B for the gain and Option D for the loss preferring a risky chance to avoid certain loss.
D. Anita and Lata will likely choose Option A for the gain but Option D for the loss, as people tend to avoid risks when gaining but prefer risks when trying to avoid losses.

6. Two firms, Firm 1 and Firm 2, are merging into two divisions of a larger firm and need to decide on a common computer system to use after the merger. In the past, Firm 1 has been using system I, and Firm 2 has been using system A. Both firms 1 & 2 will be better off if they continue using the same system (which they were using before the merger) than if they change to a different system. The outcomes, in terms of employee productivity, based on their choices, are as follows:

If both firms choose system I: Employees of Firm 1 achieves a productivity of 3, and employees of Firm 2 achieves a productivity of 2
If Firm 1 chooses system I and Firm 2 chooses system A: Employees of both firms achieve a productivity of 1
If Firm 1 chooses system A and Firm 2 chooses system I: Employees of both firms achieve a productivity of 1
If both firms choose system A: Employees of Firm 1 achieves a productivity of 2 and Firm 2 achieves a productivity of 3

Use the outcomes as respective payoffs and find if the Nash equilibrium exists in any of the following options or not. (3 marks)

Answer:

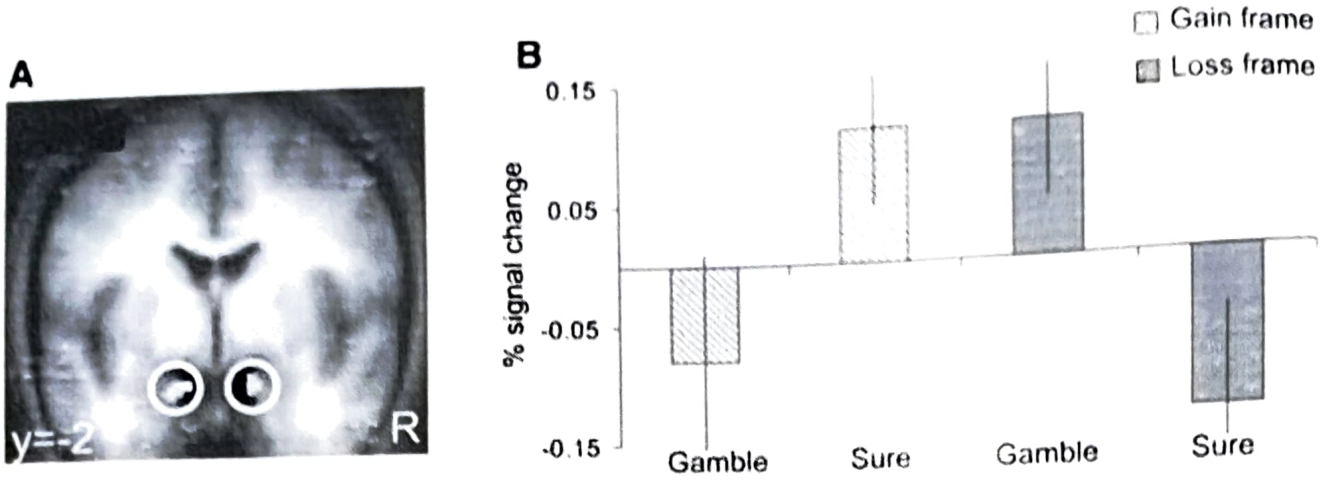
A. Both firms choose System I.
B. Firm 1 chooses System I, and Firm 2 chooses System A.
C. Firm 1 chooses System A, and Firm 2 chooses System I.
D. Both firms choose System A.
E. Both A and D
F. Both B and C
G. A, B, C, and D
H. There is no Nash equilibrium

7. In a cognitive science study investigating judgment under uncertainty, a researcher is examining how individuals interpret the results of a drug test. The drug test is 98% accurate in detecting drug users (true positive rate) and 98% accurate in identifying nonusers (true negative rate). However, only 0.5% of the population uses the drug. A participant is randomly selected from this population and tests positive for the drug. Given the test's accuracy and the low prevalence of drug use in the population, what is the probability that the participant actually uses the drug? (2 marks)

Answer:

A. 5.2%
B. 19.8%
C. 50%
D. 98%

8. Person A went to a casino to try his luck. He was instructed that he would not be able to retain the whole of the initial amount i.e. ₹5000, but would next have to choose between a sure option and a gamble option. The sure option was presented in the Gain frame as an amount of money retained from the starting amount (e.g., keep ₹2000 of ₹4000) and in the Loss frame as an amount of money lost from the starting amount (e.g., lose ₹3000 of the ₹5000). The gamble option represented the probability of winning or losing all of the starting money. The expected outcomes of the gamble and sure options were equivalent. As per the framing effect, the encircled region in panel (A) shows greater activation (positive % signal change) during the sure option in the gain frame and gamble option in the loss frame as depicted in the panel (B). Identify the encircled region from the given options (2 marks)



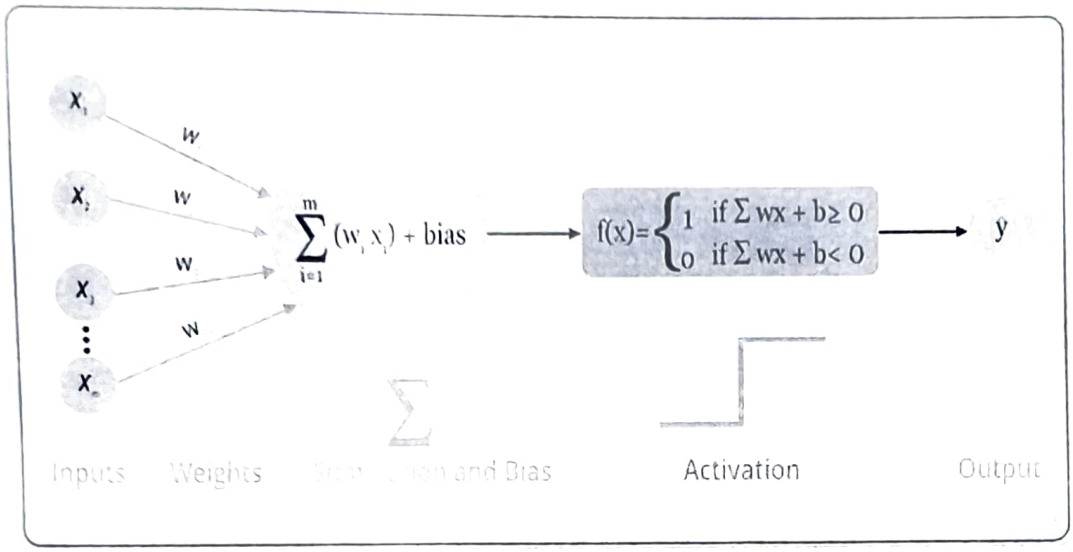
A. Anterior Cingulate Cortex
B. Prefrontal Cortex
C. Amygdala
D. Orbitofrontal Cortex
E. None of the above

9. An individual must decide whether to take an umbrella or leave it behind. The probability of rain is 0.6. If the individual takes the umbrella, they will be burdened but stay dry, receiving a utility of U=5, regardless of the weather. If they leave the umbrella behind, they will get wet if it rains (U=0) but will enjoy the freedom of being unburdened and dry if it does not rain (U=10). Using the concept of expected utility theory, consider how a risk-neutral individual might approach this decision. Which of the following statements best describes the reasoning and decision-making process in this scenario? (3 Marks)

Answer:

A. The expected utility of taking the umbrella is greater than or equal to the expected utility of leaving it, regardless of the probability of rain.
B. The expected utility of leaving the umbrella is greater than or equal to the expected utility of taking it, regardless of the probability of rain.
C. The individual's decision will be based on the utilities assigned to each outcome, not the probabilities of rain or no rain.
D. The individual will take the umbrella, as its expected utility is higher than the expected utility of leaving the umbrella, given the current probabilities and utilities.
E. The individual will leave the umbrella, as its expected utility is higher than the expected utility of taking the umbrella, given the current probabilities and utilities.

10. In the design of an artificial neuron inspired by biological neural circuitry, which option correctly matches the components and functions of an artificial neuron with their biological counterparts? (3 marks)



Answer:

A. Weights in an artificial neuron correspond to the synaptic strength in biological neurons.
B. The inputs to an artificial neuron correspond to the threshold potential in biological neurons.
C. The output of an artificial neuron is comparable to a neuron's action potential transmitted along the axon.
D. The weights are comparable to excitatory and inhibitory potentials in biological neurons.
E. The output of an artificial neuron corresponds to synaptic strength in biological neurons.
F. The inputs to an artificial neuron are analogous to excitatory and inhibitory potentials at a biological neuron's dendrites.
G. A, C, F
H. A, B, E
I. D, C, F

11. Suppose that in some brain area we have a group of 500 neurons. All neurons have identical parameters and they all receive the same input. Input is given by sensory stimulation and passes through 2 preliminary neuronal processing steps before it arrives at our group of 500 neurons. Within the group, neurons are not connected to each other.
Imagine the brain as a model network containing 100 000 nonlinear integrate-and-fire neurons, so that we know exactly how each neuron functions.
Experimentalist A makes a measurement in a single trial on all 500 neurons using a multi-electrode array, during a period of sensory stimulation.
Experimentalist B picks an arbitrary single neuron and repeats the same sensory stimulation 500 times (with long pauses in between, say one per day).
Experimentalist C repeats the same sensory stimulation 500 times (1 per day), but every day he picks a random neuron (amongst the 500 neurons).
All three determine the time-dependent firing rate. Which of the following statement is true? (2 marks)

Answer:

A. A, B and C are expected to find the same result.
B. A and B are expected to find the same result, but that of C is expected to be different.
C. B and C are expected to find the same result, but that of A is expected to be different.
D. A and C are expected to find the same results, but that of B is expected to be different.
E. None of the above three options is correct.

12. In an experiment on a neuron in the inferior colliculus, a series of auditory clicks are presented at different rates. The neuron fires precisely time-locked to each click when the click rate is low (10 Hz), but at high click rates (100 Hz), the firing becomes asynchronous and the timing jitter increases. A researcher claims that this neuron switches from temporal

coding at low rates to rate coding at high rates. Which of the following observations would most strongly support this claim? (2 marks)

Answer:

A. At high click rates, the average firing rate of the neuron correlates with the click rate, while at low rates, it does not.
B. At low click rates, the spike times have low jitter, while at high rates, jitter is high.
C. At high click rates, the information about click rate can be decoded from the firing rate, but at low rates, it requires spike timing.
D. The neuron receives inhibitory inputs at high click rates that reduce its temporal precision.
E. Other neurons in the inferior colliculus show similar behaviour.

13. A neuron maintains a steep electrochemical gradient for several ions: a high extracellular sodium concentration, a high intracellular potassium concentration, and the presence of chloride and calcium in the extracellular fluid. Which of the following statements are INCORRECT with regards to this description? (2 marks)

Answer:

A. The sodium-potassium pump (Na+/K+) is actively functioning in this neuron.
B. The membrane is most permeable to potassium ions (K^+) at this moment.
C. The neuron is currently generating an action potential.
D. The intracellular environment is electrically negative relative to the extracellular environment.
E. The neuron is in a state where it is ready to respond to a depolarizing stimulus.
F. Only A and C
G. Only D and E
H. Only B and E

14. You investigate the neural basis of two cognitive tasks: Task A (face recognition) and Task B (object recognition). You have data from three sources:

1. Lesion studies:
   - Patient P1 with a focal lesion in the Fusiform Face Area (FFA) is impaired on Task A but normal on Task B.
   - Patient P2 with a focal lesion in the Lateral Occipital Complex (LOC) is impaired on Task B but normal on Task A.
2. fMRI in healthy controls:
   - Both Task A and Task B activate FFA and LOC, but Task A activates FFA more strongly, and Task B activates LOC more strongly.
3. TMS studies:
   - Applying TMS to FFA in healthy participants disrupts Task A but not Task B.
   - Applying TMS to LOC disrupts Task B but not Task A.

Which of the following conclusions are supported by these findings? (3 marks)

Answer:

A. The lesion and TMS data provide a double dissociation, indicating that FFA and LOC are necessary for Task A and Task B, respectively.
B. The fMRI activation overlap suggests that FFA and LOC are involved in both tasks, so the double dissociation from lesions is invalid.
C. The findings demonstrate that Task A and Task B rely on entirely independent neural networks with no shared resources.
D. The TMS results confirm the causal roles of FFA and LOC, complementing the lesion data

E. Since both tasks activate both regions, the impairments in patients must be due to diaschisis rather than direct functional loss.
F. The double dissociation implies that Task A and Task B are cognitively independent, but the fMRI data suggest some shared neural resources.
G. Only A and E are correct. Only A and E are correct
H. Only A, B, and E are correct.
I. Only E and [redacted] are correct.
J. Only A, D and F are correct
K. Only A, D, and [redacted] are correct.
L. Only A, E, F and [redacted] are correct

15. The Iowa Gambling Task demonstrates that the brain is making decisions without an individual being completely aware of these decisions. If a subject participating in the Iowa Gambling Task has frontal lobe damage, what can we expect to observe as a result? (2 marks)

Answer:

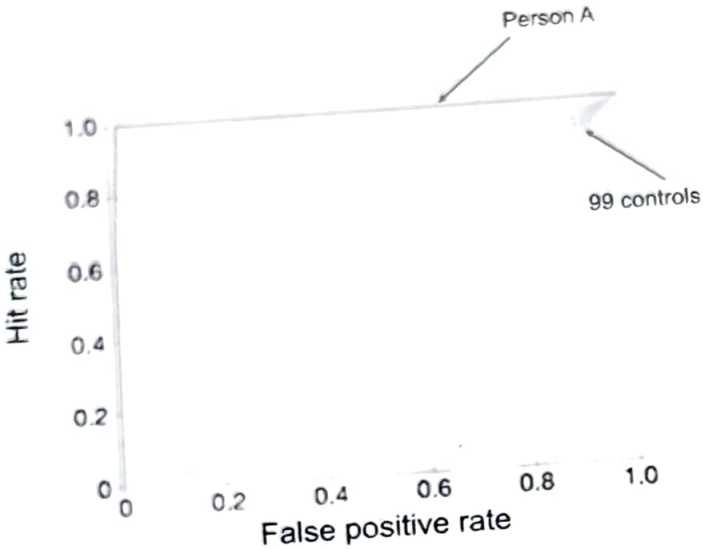
A. The subject will show a high anticipatory skin conductance response and will quickly learn to avoid the riskier card decks and draw from the higher-payoff decks.
B. The subject will initially show an anticipatory skin conductance response, but over time will stop exhibiting an SCR.
C. The subject will not show an anticipatory skin conductance response and will not learn to avoid the riskier card decks
D. The subject will draw from the decks in a very random pattern while exhibiting a skin conductance response after drawing from each deck.

16. Which of the following parameter combinations would produce the FASTEST average reaction times while maintaining at least 80% accuracy for a task with medium difficulty (drift rate ≈ 0.1)? (2 marks)

Answer:

A. Threshold = 0.05, Starting point = 0
B. Threshold = 0.1, Starting point = 0.02
C. Threshold = 0.15, Starting point = 0
D. Threshold = 0.1, Starting point = 0
E. Threshold = 0.08, Starting point = 0.01
F. Only A and B are correct.
G. Only B and E are correct.
H. Only B and C are correct.
I. Only D and E are correct.
J. Only A, B, and E are correct.

17. During analysis of a right anterior hippocampal neuron, the experimenters computed an ROC curve comparing responses to seven distinct pictures of Person A versus 80 other images depicted in the figure below. The AUC for this neuron was 0.99, while control analyses (99 random sets of 7 images) yielded AUCs with mean = 0.55 ± 0.05 (SD). The neuron also responded to the letter string of the Person A's name.



Which of the following inferences are valid given these data? (2 marks)

Answer:

A. The neuron's responses are statistically indistinguishable from random selectivity (no evidence for invariance).
B. The probability that such an AUC arises by chance is < 0.01, meeting the study's invariance criterion.
C. Lowering the response threshold would increase both hit and false-positive rates.
D. The ROC result implies that spike count distributions for preferred vs. non-preferred images are well separated.
E. Given the near-unit AUC, this cell's selectivity can be fully explained by tuning to a common visual feature (e.g., color balance).
F. The neuron's response is part of an abstract, concept-based code, not a low-level visual-feature code
G. These findings support a sparse distributed coding scheme in the human medial temporal lobe.
H. These findings support a fully distributed coding scheme in the human medial temporal lobe.
I. Only B, C, D, F and G
J. Only B and C are correct.
K. Only B, C, D and H are correct.
L. Only C, D, and F are correct.
M. Only C, E and H
N. C, D, E and H
O. Only A, B, and C are correct.

Answer key: NDM (End Sem 2025)

1. Answer: D - A participant whose indifference point remains high even for long delays must have a low discount rate (small k), generating a shallow hyperbolic curve, and would most likely resemble the controls-money curve

2. Answer: H - A and B

3. Answer: C - Recency effect

4. Answer: E - Confidence is based on how strong the motion feels early in the trial, but accuracy improves as more evidence accumulates over time.

5. Answer: D - Anita and Lata will likely choose Option A for the gain but Option D for the loss, as people tend to avoid risks when gaining but prefer risks when trying to avoid losses.

6. Answer: E - Both A and D

7. Answer: B - 19.8%

8. Answer: C - Amygdala

9. Answer: D - The individual will take the umbrella, as its expected utility is higher than the expected utility of leaving the umbrella, given the current probabilities and utilities.

10. Answer: G - A, C, and F

11. Answer: A - A, B and C are expected to find the same result.

12. Answer: C - At high click rates, the information about click rate can be decoded from the firing rate, but at low rates, it requires spike timing.

13. Answer C - The neuron is currently generating an action potential.

14. Answer J - Only A, D and F are correct

15. Answer C - The subject will not show an anticipatory skin conductance response and will not learn to avoid the riskier card decks.

16. Answer G - Only B and E are correct.

17. Answer I - Only B, C, D, F and G

Nash Equilibrium

Payoff matrix (Firm1, Firm2):

- (I,I) → (3,2)
- (I,A) → (1,1)
- (A,I) → (1,1)
- (A,A) → (2,3)

A strategy profile is a Nash equilibrium if neither firm can increase its own payoff by unilaterally changing its choice.

1. **(I,I)**:
   - Firm1: payoff 3. If Firm1 deviates to A while Firm2 stays I → payoff becomes 1 (worse).
   - Firm2: payoff 2. If Firm2 deviates to A while Firm1 stays I → payoff becomes 1 (worse).

   → **No profitable unilateral deviation ⇒ (I,I) is a Nash equilibrium**.
2. **(A,A)**:
   - Firm1: payoff 2. Deviating to I (while Firm2 stays A) gives payoff 1 (worse).
   - Firm2: payoff 3. Deviating to I (while Firm1 stays A) gives payoff 1 (worse).

   → **No profitable unilateral deviation ⇒ (A,A) is a Nash equilibrium**.
3. **(I,A)**:
   - Firm1 gets 1. If Firm1 switches to A (while Firm2 stays A) it would get 2 (better) ⇒ profitable deviation.

   → **Not a Nash equilibrium**.
4. **(A,I)**: symmetric to (I,A) → **Not a Nash equilibrium**.