BRAC University
Department of Computer Science and Engineering

CSE 443: Bioinformatics-I (A)

Quiz 04: Summer 2025 Time: 15 Minutes Marks: 15

Name		ID		Section	

Q1. The Viterbi algorithm computes: (A) Probability of observed sequence (B) Most probable state path (C) Posterior probabilities (D) HMM parameters

Q2. In log-space Viterbi, the recurrence uses: (A) Sum of probabilities (B) Product of probabilities (C) Maximum of sums of log-probabilities (D) Minimum of probabilities

Q3. For emissions: $P(G|B) = 0.25$, $P(G|I) = 0.40$. Observing G favors: (A) Background (B) Island (C) Both (D) None

Q4. Backpointers in Viterbi are used to: (A) Calculate emission probabilities (B) Reconstruct the most likely state sequence (C) Normalize probabilities (D) Update parameters

Q5. With transition $P(I \to I) = 0.9$, after 5 consecutive I's, the probability of staying in I is approximately: (A) 0.9 (B) 0.9^5 (C) 0.1^5 (D) 5×0.9

Q6. CpG islands are regions of DNA with: (A) Higher A/T content (B) Higher C/G content (C) Repeats only (D) Random bases

Q7. The time complexity of Viterbi for length n, states k: (A) $O(n)$ (B) $O(nk)$ (C) $O(nk^2)$ (D) $O(k^n)$

Q8. If $P(B) = 0.5, P(I) = 0.5$, emissions $P(A|B) = 0.3, P(A|I) = 0.1$, and first symbol is A, which state is favored? (A) B (B) I (C) Both (D) Neither

Q9. Which algorithm is best for most likely segmentation of genome? (A) Forward (B) Viterbi (C) Baum-Welch (D) Smith-Waterman

Q10. Which is **not** a typical HMM problem? (A) Decoding (B) Evaluation (C) Learning (D) Protein structure alignment

Q11. For sequence GCGC, background: 0.25 each, island: 0.4 (G,C), 0.1 (A,T). Which state is favored? (A) Background (B) Island (C) Equal (D) None

Q12. The initialization step of Viterbi uses: (A) Initial probs $\times$ emission of first symbol (B) Transitions only (C) Emissions only (D) Backpointers only

Q13. A gene-rich region often overlaps with: (A) CpG islands (B) Introns (C) Tandem repeats (D) AT-rich deserts

Q14. The "backpointer array" ensures: (A) Higher emissions (B) Traceback of path (C) Avoids underflow (D) Improves complexity

Q15. In CpG detection, the island state has: (A) Equal base probabilities (B) Higher C/G emissions (C) Higher A/T emissions (D) No emissions