

Biomedical Computing and Biological Informatics

Computer Science · Answer Key · 12 Questions

1. Which protein structure prediction tool, developed by DeepMind, utilizes an attention-based neural network architecture to solve the 'protein folding problem'?

- A) AlphaFold2**
- B) Rosetta@home
- C) Folding@home
- D) PyMOL

2. In bioinformatics, what is the primary computational challenge associated with the Smith-Waterman algorithm when comparing two human genome sequences?

- A) Memory bottlenecking
- B) Quadratic time complexity**
- C) Lack of parallelism
- D) Floating-point overflow

3. Which specific data format is the international standard for representing high-throughput DNA sequencing data, containing both nucleotide sequences and quality scores?

- A) FASTA
- B) FASTQ**
- C) SAM
- D) BAM

4. What is the term for the computational process of aligning short DNA sequence reads to a reference human genome, typically utilizing the Burrows-Wheeler Transform?

- A) Read mapping**
- B) Sequence stitching
- C) De novo assembly
- D) Base calling

5. In fMRI data processing, what is the primary function of the 'General Linear Model' (GLM) in statistical parametric mapping?

- A) Isolating vascular noise
- B) Estimating neural response amplitudes**
- C) Data compression
- D) Image segmentation

6. Which specific heuristic algorithm is used by the BLAST (Basic Local Alignment Search Tool) software to find high-scoring segment pairs between protein or DNA sequences?

- A) K-mer word matching**
- B) Dynamic programming
- C) Hidden Markov Models
- D) Support Vector Machines

7. What is the primary objective of the 'DICOM' standard in medical informatics?

- A) Standardizing genomic data
- B) Transmitting and storing medical imaging data**
- C) Standardizing electronic health records
- D) Protocol for remote surgery

8. In computational neuroscience, what do the Hodgkin-Huxley equations mathematically model?

- A) Synaptic plasticity
- B) Action potential initiation and propagation**
- C) Neurotransmitter diffusion
- D) Blood-brain barrier permeability

9. Which algorithm is commonly employed to perform 'dimensionality reduction' on single-cell RNA sequencing data to visualize clusters of distinct human cell types?

- A) t-SNE (t-Distributed Stochastic Neighbor Embedding)**
- B) Linear Regression
- C) Decision Trees
- D) K-Nearest Neighbors

10. Within the context of pharmacogenomics, what are 'SNPs' (Single Nucleotide Polymorphisms) most frequently mapped against in association studies?

- A) Human phenotypic traits**
- B) Protein secondary structures
- C) Neural network weights
- D) Metabolic pathway latency

11. What is the computational purpose of a 'Hidden Markov Model' (HMM) when applied to identifying gene regions in human DNA sequences?

- A) Assigning probabilities to hidden states representing biological features**
- B) Accelerating decryption of genomic data
- C) Encoding visual data from retinal implants
- D) Predicting post-operative recovery time

12. In modern glucose monitoring systems, what type of control loop architecture is typically used to manage insulin delivery in 'artificial pancreas' algorithms?

A) Proportional-Integral-Derivative (PID) control

B) Unsupervised deep reinforcement learning

C) K-means clustering

D) Static rule-based Boolean logic