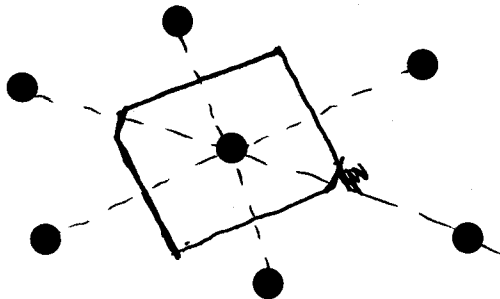


Name: KEY  
Bioinformatics Quiz #2  
03/23/2009

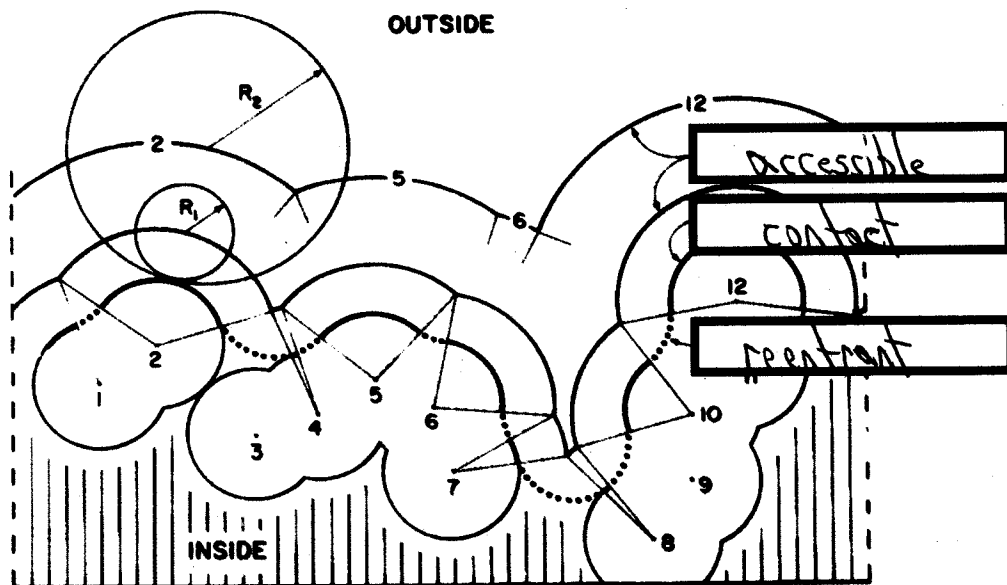
1) How does structural alignment violate the dynamic programming principle?  
[10 pts]

aligning a residue can affect previously optimal alignments of prior residues

2) Draw the Voronoi volume for the central atom (black circle) in the figure below:  
[5 pts]



3) Label the molecular surfaces in the figure below (red boxes): [9 pts]



4) The Voronoi volume of an atom is a weighted average of distances to all its neighbors, where the weighting factor is the \_\_\_\_\_. [5 pts]

- A) distance from the closest neighbor's centroid
- B) contact area with the neighbor
- C) torsion angle between atoms
- D) magnitude of the Van der Waals force
- E) none of the above

5) Briefly explain simulated annealing. [10 pts]

Heat simulation to high  $T$ , gradually cool and minimize to find global minimum

6) In network analysis, what probability distribution is used to calculate enrichment? [5 pts]

hypergeometric

7) Dijkstra's algorithm is used to: [5 pts]

- A) find the path traveling through the fewest nodes
- B) calculate the clustering coefficient
- C) find the shortest path in a graph between two nodes
- D) find the path that visits each node exactly once
- E) none of the above

8) Semantic web: What does OWL stand for? [5 pts]

Web Ontology Language

9) Phylogenomics: Name three factors that cause incongruent gene histories. [9 pts]

- ① loss of close orthologs
- ② horizontal gene transfer
- ③ lineage-specific evolutionary rate acceleration

10) Briefly explain the differences between Woese's Domains of life and the Five Kingdom system. Why is the Five Kingdom system deficient? [12 pts]

Five Kingdom system	Woese's Domain of Life
• Based on morphology	• Based on 16S rRNA

5-kingdom system groups all prokaryotes into Monera (does not adequately reflect diversity of life)

11) What is principal component analysis (PCA)? When is it applied? [10 pts]

- Principal component analysis is a dimensionality reduction technique.
- Change of basis
- The first principal component accounts for most of the variability

12) When does PCA produce the same result as Single-Value Decomposition (SVD)? [5 pts]

- A) PCA never produces the same results as SVD
- B) PCA always produces the same results as SVD
- C) When the data points are translated with respect to the original origin
- D) When the data points are centered with respect to the original origin
- E) None of the above

13) Why does metagenomics reveal information about microbial communities that can't be determined using a traditional genomics approach? [10 pts]

- Many microorganisms cannot be isolated and cultured
- Identify pathway on a community wide scale