

CBB752 Final Quiz, Spring 2010

Name: _____

200 points in total

1. Explain the difference between local and global optimization [8 points].
2. What is the difference between a deterministic and stochastic model? Which term applies to Ordinary Differential Equation (ODE) models? [8 points]
3. In the context of mathematical modeling, what is an F test used for? [12 points]
4. Assume that B and M are two different cell types (e.g., Naïve B cells (B) and memory B cells (M)). Write a brief description of the potential meaning for each parameter in the model: [20 points]

$$\frac{dB}{dt} = s + pB - cB - tB$$
$$\frac{dM}{dt} = tB - cM$$

10. After running a ChIP-Seq experiment targeting factor X, you find that only 30% of the peaks contain the known motif for factor X. Assuming no experimental error, explain using *diagrams and text* the possible reasons why the motif may be underrepresented. [20 points]

11. In detail using text and diagrams, explain how an index-based short-read mapping algorithm works. Why are spaced-seeds necessary when using this approach? Make sure to show the spaced seeds approach in your diagram. [20 points]

12. What is the main drawback of microarrays compared to RNA-Seq? Name three new applications using RNA-Seq that were not possible with tiling arrays. [10 points]

13. Rank the following program in terms of sensitivity (1 = most sensitive, 6 = least sensitive) for finding sequence alignments: [12 points]

- ___ Bowtie
- ___ BLAST
- ___ Smith-Waterman
- ___ HMM
- ___ PSI-BLAST
- ___ Sequence Profiles

14. What are the advantages of using a Biplot to represent a data matrix? [10 points]

15. Explain how PCA works and why it is relevant to biological data sets? What is the interpretation of the principal components and what are the loadings? Explain the role of PCA in eigenfaces analysis presented in class. [20 points]