Submission is through our course instance of the interactive online textbook on the Cogniterra website (https://cogniterra.org/course/556/).

Note for HW1 you can start working on it without access to that here:

https://www.bioinformaticsalgorithms.org/bioinformatics-chapter-1

All assigned problems from the interactive online textbook (Q# indicates the specific step of the lesson).

Problems with a (*) are not required or graded but are recommended and could be useful preparation for other homework problems, projects, or exams.

HW1 – Chapter 1 (due Tue Jan 14, 2025 at 12pm)

1.2. Hidden Messages in the Replication Origin: Q6

1.3. Some Hidden Messages are More Surprising than Others: Q2

1.4. An Explosion of Hidden Messages: Q5

1.7. Peculiar Statistics of the Forward and Reverse Half-Strands: Q10

1.8. Some Hidden Messages are More Elusive than Others: Q3, Q6, Q9

1.11. CS: Generating the Neighborhood of a String: Q4

HW2 – Chapter 9 (due Tue Jan 21, 2025 at 12pm)

9.3. Herding Patterns into a Trie: Q4

9.5. Suffix Trees: Q4, Q5 (both Q4 and Q5 are extra credit for undergraduates; required for graduate students)

9.6. Suffix Arrays: Q2

9.7. The Burrows-Wheeler Transform: Q5

9.9. The First-Last Property and Burrows-Wheeler Inversion: Q11* (recommended)

9.10. Pattern Matching with the Burrows-Wheeler Transform: Q8* (recommended)

9.11. Speeding Up Burrows-Wheeler Pattern Matching: Q7* (recommended)

HW3 – Chapter 5 (due Tue Jan 28, 2025 at 12pm)

5.4. Sequence Alignment is the Manhattan Tourist Problem in Disguise: Q3

5.6. The Manhattan Tourist Problem Revisited: Q6, Q10

5.8. Backtracking in the Alignment Graph: Q5

5.10. From Global to Local Alignment: Q3* (recommended)

5.11. The Changing Faces of Sequence Alignment: Q3* (recommended)

5.13. Space-Efficient Sequence Alignment: Q12* (recommended)

HW4 – Chapter 3 (due Mon Feb 4th, 2025 at 12pm)

3.2. The String Reconstruction Problem: Q3

3.3. String Reconstruction as a Walk in the Overlap Graph: Q3, Q10

3.4. Another Graph for String Reconstruction: Q6

3.5. Walking in the de Bruijn Graph: Q8

3.8. From Euler's Theorem to an Algorithm for Finding Eulerian Cycles: Q2, Q6, Q7

HW5 – Chapter 8 (due Tue Feb 18th, 2025 at 12pm)

8.6. Farther First Traversal: Q2* (recommended)

8.7. k-Means Clustering: Q3

8.8. The Lloyd Algorithm: Q3

8.14. Hierarchical Clustering: Q7

HW6 – Chapter 2 (due Tue Feb 25th, 2025 at 12pm)

2.2. Motif Finding Is More Difficult Than You Think: Q8

2.5. Greedy Motif Search: Q2, Q3

2.6. Motif Finding Meets Oliver Cromwell Q9* (recommended)

2.7. Randomized Motif Search: Q5* (recommended)

2.9. Gibbs Sampling: Q11* (recommended)

HW7 – Chapter 10 (due Tue Mar 11th, 2025 at 12pm)

10.5. Hidden Markov Models: Q8* (recommended), Q10

10.6. The Decoding Problem: Q7* (recommended)

10.7. Finding the Most Likely Outcome of an HMM: Q4* (recommended)

10.11. Learning the Parameters of an HMM: Q4

10.12. Soft Decisions in Parameter Estimation: Q5

10.13. Baum-Welch Learning: Q5