

## CS 320 Study Guide (Sections 3.3, 3.4)

### Section 3.3

#### 1. Closest Pair problem

- In your own words, describe this problem. Make sure to explain the form of the input and the output.
- Describe at a "high level" the brute force algorithm for this problem.
- Create a "random" instance of this problem by generating a set of 4 points (use Python's `randrange(1, 11)` to generate the coordinates) and follow the brute force algorithm from part b to solve it.
- In general, how many "candidates" would the brute force algorithm have to evaluate for problem of size  $n$ ? Make sure to include the work/reasoning that justifies your conclusion.

#### 2. Convex Hull Problem

- In your own words, describe this problem. Make sure to explain the form of the input and the output.
- Create a "random" instance of this problem by generating a set of 8 points using Python's `randrange(1, 11)`. Solve the problem visually by plotting the points.
- Describe at a "high level" the brute force algorithm for this problem.
- How many lines does this algorithm have to consider, and how many line-point sign comparisons does it have to make for an instance of  $n$  points?

### Section 3.4

#### 3. Traveling Salesperson Problem

- In your own words, describe this problem. Make sure to explain the form of the input and the output.
- Describe at a "high level" the brute force algorithm for this problem.
- Create a "random" instance of this problem by generating a fully connected graph of 4 vertices. (Use Python's `randrange(1, 11)` to generate the weights). Follow the brute force algorithm from part b to solve it.
- In general, how many "candidate solutions" would the brute force algorithm have to evaluate for a problem of size  $n$ ? Make sure to include the work/reasoning that justifies your conclusion.

#### 4. Knapsack Problem

- a. In your own words, describe this problem. Make sure to explain the form of the input and the output.
- b. Describe at a "high level" the brute force algorithm for this problem.
- c. Create a "random" instance of this problem involving 3 items and solve it using your algorithm.
- d. In general, how many "candidate solutions" would the brute force algorithm have to evaluate for a problem of size  $n$ ? Make sure to include the work/reasoning that justifies your conclusion.

#### 5. Assignment problem

- a. In your own words, describe this problem. Make sure to explain the form of the input and the output.
- b. Describe at a "high level" the brute force algorithm for this problem.
- c. Create a "random" instance of this problem involving 3 jobs/people and solve it using your algorithm.
- d. In general, how many "candidate solutions" would the brute force algorithm have to evaluate for a problem of size  $n$ ? Make sure to include the work/reasoning that justifies your conclusion.