

A5. [5 points each]. Give the best time complexity bound that you are aware of for each of the following problems and give a couple of keywords identifying a method to achieve the result. The time complexity bound should be for the worst case.

1. Finding the 2 largest and 2 smallest of  $n$  numbers: \_\_\_\_\_

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2. Finding the “top quartile” of a set of  $n$  numbers ( $3/4$  lower,  $1/4$  higher than desired element): \_\_\_\_\_

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3. Determining if a list of  $n$  integers has two distinct integers whose sum is  $M$ : \_\_\_\_\_

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4. Finding the longest path in a graph: \_\_\_\_\_

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5. Finding a closest pair of a set of  $n$  points in the plane: \_\_\_\_\_

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6. Determining the edge set  $E$  for a random geometric graph  $G(n, r)$ : \_\_\_\_\_

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NAME: \_\_\_\_\_

**Part A. Closed Book (no computer access).** {60 minutes} [150 points] Complete and submit before starting Part B.

A1. [5 points each] Give one or two sentence descriptions of each of the following terms.

1. Lookup table: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

2. Binary search: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

3. Planar graph: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

4. Data structures is the field of computer science that: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

5. Decision problem: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. Algorithm complexity: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7. Problem complexity: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

8. Greedy algorithm: \_\_\_\_\_

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\_\_\_\_\_

\_\_\_\_\_

A2. Algorithm Engineering Tools [6 points each]. (be concise).

1. The purpose for employing Booth recoding is: \_\_\_\_\_

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2. The purpose for employing a decision tree is: \_\_\_\_\_

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3. The purpose for employing a doubly linked list is: \_\_\_\_\_

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4. The purpose for employing an on-the-fly algorithm is: \_\_\_\_\_

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5. The purpose for employing a proof that a problem is NP-complete is: \_\_\_\_\_

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