

ECS122A Midterm, Fall 2025

13 November, 2025

Answer Booklet

Full Name (as it appears on your Student ID): _____

Instructions

- The time allotted for this exam is 6:20–7:30 PM (1 hour and 10 minutes).
- This exam has three short algorithmic problems (each worth 20 points), where the intended algorithms are one of each of Divide and Conquer, Dynamic Programming and Greedy Algorithms. You may however design any correct algorithm that runs in the specified runtime, for any of the problems.
- There are bonus questions for two of the three algorithm problems, and they are optional, each being worth 10 points.
- You will need to prove the correctness of your algorithm, as well as show its efficiency, in order to receive full credit for a problem.
- **Correct but less efficient algorithms may receive partial credit.**
- The exam is to be completed on this exam paper. You are highly encouraged to use the templates, although you are also provided with two extra “blank” templates. If you need more template sheet(s), please raise your hand to request them.
- You may *not collaborate* with anyone and you *may not* consult any outside materials *except* notes written/typed on one two-sided US letter-sized paper (size 8.5" × 11.0") that you bring to the exam per the prior instructions sent to the whole class.

Template for Dynamic Programming Solution

Problem number ____

1. Define your DP table, including its size, indexing and *precise* meaning of each table entry

2. State your algorithm's recurrence and base cases

3. Prove that the stated recurrence is true

(Turn the page)

4. Pseudocode to fill out the DP table

5. Argue why, by the time your algorithm uses the recurrence to fill out a particular table entry, the dependent entries have already been filled in

6. Pseudocode/description for computing the final answer from the filled-in DP table

7. What is the runtime of your entire algorithm and why?

Template for Divide and Conquer Solution or Greedy Solution

Problem number ____

1. State your algorithm

2. Induction on the execution of the algorithm

Induction Hypothesis:

Induction Step:

(Turn the page)

3. Wrap up: How does the result of the induction imply the overall algorithm's correctness?

4. What is the runtime of your entire algorithm and why?

Template for Divide and Conquer Solution or Greedy Solution

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1. State your algorithm

2. Induction on the execution of the algorithm

Induction Hypothesis:

Induction Step:

(Turn the page)

3. Wrap up: How does the result of the induction imply the overall algorithm's correctness?

4. What is the runtime of your entire algorithm and why?

Blank Template (for Problem 2.1, or for any other problem)

Problem number ____

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Blank Template (for Problem 2.1, or for any other problem)

Problem number ____

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