2024 CSE431531 In class Quiz 8 Schedule

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Note:

- Form groups of EXACTLY **two** students. You may form a group through a Piazza post.
- Discuss the **assigned** problem
  - Students with answer sheet Number $1, 5, 9, ..., 4i + 1$: Problem 1
  - Students with answer sheet Number $2, 6, 10, ..., 4i + 2$: Problem 2
  - Students with answer sheet Number $3, 7, 11, ..., 4i + 3$: Problem 3
  - Students with answer sheet Number $4, 8, 12, ..., 4i$: Problem 4

  We will review the problems in class.
- Outline your solution in the Answer Sheet
  - State the Divide Steps in no more than two sentences
  - State the Conquer Steps in no more than two sentences
  - State the Combine Steps in no more than two sentences
  - Divide-and-conquer algorithm pseudo code in fewer than 15 lines
  - Recurrence relations and running time in fewer than 2 lines
- We will distribute the answer sheets during class to each group, consisting of exactly two students seated together. Each pair of students will receive one answer sheet, which will have a designated **SheetNumber**.
- **You should submit the answer sheet paper before the end of the class.**

  For the after class **late submission (with 50% deduction)**, both students in a group must submit the same scanned answer sheet. Please note that submissions for "In class Quiz 8 submission" on Ublearns Assignment will close **today at 11:59 PM on Oct 11th.**

  If submitting after class, please scan your assigned answer sheet and name the PDF file: Quiz8_SheetNumber_FirstStudentUBIDnumber_SecondStudentUBIDnumber

  For example: Quiz8_53_12345678_12345678
- No makeup in-class quiz will be given except in provably extreme circumstances.

Problem 1: Modular Exponentiation Problem Modular exponentiation is key in cryptography, particularly in RSA encryption. It computes the remainder of an integer raised to a high power modulo a number, used for encrypting and decrypting messages, generating digital signatures, and key exchange in secure protocols. Its efficiency and security are crucial for ensuring data confidentiality and integrity in cryptographic systems.

- Input: integer a, n and m
- Output: $a^n \mod m$

Problem 2: Matrix Multiplication Problem Matrix multiplication is a key operation in neural networks, where each layer of neurons is associated with a weight matrix. This allows for a linear transformation of inputs, akin to a weighted sum, which is central to the functioning of artificial neural networks.

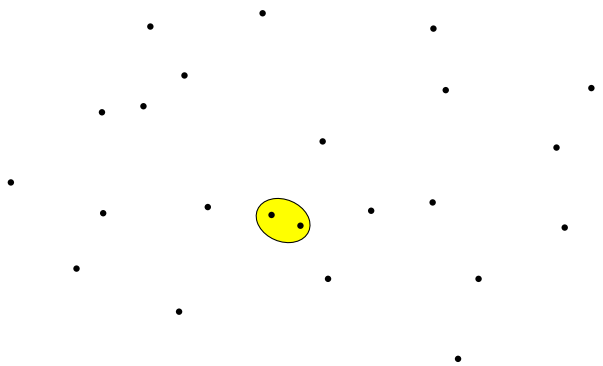
- Input: two $n \times n$ matrices A and B
- Output: $C = AB$

Problem 3: Closest Pair Problem In GPS navigation systems, the Closest Pair Problem revolves around identifying the closest points of destinations to minimize travel time and create efficient routes for users.

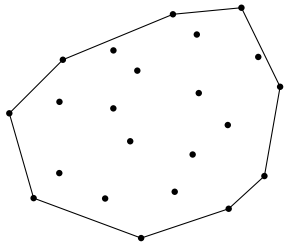
- Input: n points P in plane: $(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n)$
- Output: the pair of points that are closest

Problem 4: Convex Hull Problem In robotics, navigating through obstacle-cluttered environments is a major challenge. The convex hull, which is like wrapping a rubber band around points, helps identify obstacle boundaries for path planning, allowing robots to avoid collisions.

- Input: n points P in plane: $(x_1, y_1), (x_2, y_2), \cdots, (x_n, y_n)$
- Output: a representation of P's convex hull. E.g. the representation would consist of edges.



(a) Problem 3: Closest Pair of points



(b) Problem 4: Convex Hull of points P