In-Class Summative Assignment – Part 2 and Part 3

`ContactChecker` Design; Ethical Implications

Scenario

Continuing from our previous session, your team is developing the backend of a contact-tracing system that identifies when users have been near each other (within 6 feet for over 15 minutes). The system must:

- Efficiently store and query user location data
- Protect user privacy and data security
- Handle errors and bugs responsibly

Today, you'll design the internal logic and data structures that power this feature, then reflect on security, privacy, and correctness concerns that may arise in the real world.

Part 2: Data Structures and Algorithms

You will complete this Part 2 working together in groups of 2-3, of your choice, for the entirety of this assignment.

Prompt: Sketch the internal logic of the **ContactChecker** component. The ContactChecker is compute-heavy, so it must be built out of efficient data structures. Using a combination of data structures, make sure you can support:

- Efficient insertion of location data per user
- Efficient queries for recent close contacts (based on time and space)

The ContactChecker module receives data in the form **(user-id, timestamp, location)** and needs to:

- Store this data efficiently for querying
- Check whether two users were "in contact" (same place, overlapping time window)
- Return results quickly for all recent contact pairs

Include:

On separate piece that you upload to Gradescope, include:

- The data structures you would use (e.g., dictionaries, graphs, AVL trees) and how they connect to provide the required functionality.
- Time complexities for key operations (you can be informal in your reasoning, but be correct).
- A brief pseudocode sketch for `checkContact(userA, userB)` for 2 users across 3 locations and 4 timestamps

Assessment: Your submission assessed based on:

- Appropriateness and efficiency of chosen data structures
- Clarity and correctness of description and walk-through
- Justification of design choices

Be thoughtful, creative, and clear. This component must be both performant and responsible. Your design choices can affect real users.

Design Review

Find another group and explain to them your design and approach. Have them do the same. What differences in your design matter? What differences are unimportant? Would you make a change to either your overall design or your your ContactChecker component?

No submission here.

Part 3: Ethics, Privacy, and Correctness

Please answer each question on the Gradescope assignment with 2–3 thoughtful sentences. Complete this part individually

Privacy Risk

Your current system stores each user's full timestamped GPS history. **What privacy risks does this create? How could you mitigate them?**

Correctness and Reliability

Suppose your logic falsely flags someone as exposed (or fails to flag someone who was). **What ethical or legal risks arise from this error?**

Real World Example

You have been sent by email a real-world news article related to contact-tracing apps. Read your assigned article and discuss the following:

- What went wrong technically or ethically?
- What legal or privacy issues arose?
- Who's responsible, and what should happen next?
- How could better design or testing have prevented the issue?

Collected Work: Complete this by the end of class and submit to gradescope.

In-Class Timeline

- **35 min:** Design your data structures and algorithm
- **15 min:** Work with another group to compare approaches
- **20 min:** Answer ethics/reflection prompts individually
- **15 min:** Talk aloud. Volunteers share their or discuss their solutions