Asian Institute of Technology
Mid-semester Examination
August 2022

Course: AT82.02 Data Management & Modeling	Total score: 100 (20 %)
Date: Wednesday 11 October 2022	Time: 11:00-13:00 (2 hours)

Exam Instructions

- This examination is Open-Book. Number of pages: 3, Number of Questions: 3.
- **Refer to the given Case Study to answer Questions 1 to 3. For any missing details, explicitly state necessary assumptions or conditions you make. Make your assumptions rational and practical.**

Consider the following knowledge about Smart City, Smart Governance and Citizen Sourcing:

Smart City *is a city that utilizes advanced technology and innovation to enhance the efficiency of services and urban planning, to reduce the cost and resources used by the city and target population. This ideal city focuses on a good design and the participation of the business sector and people in developing the city under the concept of a better and modern city where city people will live happily and sustainably, and have a good quality of life. Smart City is divided into several categories: Smart Economy, Smart Energy, Smart Governance, Smart Living, Smart Mobility and Smart People.*

Smart Governance*: The city that develops a governmental service system with a focus on transparency and engagement to facilitate people who need to access government news and information.*
[Source: https://www.scb.co.th/en/personal-banking/stories/life-style/smart-city.html]

Citizen sourcing *is the government adoption of crowdsourcing techniques for the purposes of (1) enlisting citizens in the design and execution of government services and (2) tapping into the citizenry's collective intelligence for solutions and situational awareness. Applications of citizen sourcing include:*

- *The use of ideation tools by government agencies to collect ideas and suggestions from the public*
- *The use of problem-solving tools that allow citizens to identify and evaluate solutions to problems proposed*
- *The adoption of citizen reporting platforms, such as for crime or emergency response information*
- *The government monitoring of social media, such as Twitter, for situational awareness, such as with regard to natural disasters*

[Source: https://en.wikipedia.org/wiki/Citizen_sourcing]

Case Study: Citizen Sourcing-based System for Smart City and Smart Governance of Pathumthani (CSSS)

The government of Pathumthani Province (where AIT is located in) would like to develop a **Citizen Sourcing-based System for Smart City and Smart Governance of Pathumthani (CSSS)**, where citizens of Pathumthani can report and track any city-related issues in the following categories:

- Transportations (such as roads, busses)
- Utilities (such as electricity, water)
- Waste
- Crimes
- Health
- Accident
- Environment
- Disaster (such as fire, flood, storm)

Any citizens of Pathumthani can be users of the system and can report and track all issues. To report an issue, the citizen must define the issue title, the issue category, specific details of the issue, the location (address, GPS coordinates, etc.), the responsible government office, pictures related to the report, etc. Each issue has an ID (generated automatically), and reporting timestamp. The responsible government office can monitor and take proper actions for the reported issue, and update the issue's status accordingly, such as in-progress, completed and provide corresponding details. Citizens can freely search, track and monitor the issues. In addition, citizens can give feedback and rate their satisfaction on how the responsible offices take care of the issues.

Examples of issues:

• Issue: Water pipe broken, on 10 October 2022, in front of AIT, etc. • Responsible Office: Provincial Waterworks Authority	
• Issue: Rice field burning, on 11 October 2022, Klong 2, etc. • Responsible Office: Department of Disaster Prevention and Mitigation	
• Issue: Bad and damaged road, on 11 October 2022, in front of Lotus Pathumthani • Responsible Office: Department of Rural Roads	

Important operations and queries of CSSS include:

- Q1: A citizen reports an issue and give related details.
- Q2: A government office searches for new, open issues under its responsibility.
- Q3: A government office assigns their officers to work on the issue and update the issue's status accordingly.
- Q4: A citizen generates a monthly statistics of issues reported, grouped by issue categories and issue status, etc.
- Q5: A government officer views top-10 issues with the longest time to resolve, in a given area.

Exam Questions

1. Relational model design and data management:
    a. (20 points) Perform conceptual design and logical design. Show few sample data in your database tables with proper use of PKs, FKs.
    b. (20 points) Implement the given basic operations/queries Q1, Q2, Q3, Q4, Q5 in SQL.
    c. (5 points) Suggest an additional query (Q6) that can support the provincial governor to monitor the performance of each government office and/or understand the situation in the city, provide certain insight into the situation and/or support a plan/policy to implement such as setting new vaccination programs, field hospitals or some mobility restrictions, etc. Implement your queries in SQL.

2. Document model design and data management:
    a. (20 points) Show how to design and use document model to properly maintain data and support CSSS.
    b. (25 points) Implement the operations/queries Q1-Q6.

3. (10 points) Analyze and compare the benefits and limitations of Relational Model vs. Document Model with respect to the given case study. Which model is more appropriate and why?

-- End of Exam Paper --