Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Software Engineering

Supplementary Examination
Year 4, Semester 1 (2024)

SE4010 – Current Trends in Software Engineering

Duration: 2 Hours

October / November 2024

Instructions to Candidates:

- ◆ This paper is preceded by 10 minutes reading period. The supervisor will indicate when answering may commence.
- ◆ This paper has 4 questions.
- ◆ Answer all questions in the booklet given.
- ◆ The total mark for the paper is 100.
- ◆ This paper contains 4 pages, including the cover page.
- ◆ Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.

Question 1 _____ (20 marks)

A software development company is working on a comprehensive medical software. A team of developers are working on a prediction model where they are tasked with Classifying the possibility of a heart attack (True or False) occurring based on the data collected from the application. For this prediction a large data set with 20,000 entries, is provided to the development team by the client. Part of the statistics for dataset can be found in the below.

	Record ID	Gender	Age	Blood Type	Blood Cholesterol Level
Range	1- 20,000	Male/Female	12- 70	A+,A-,B+,B-, AB+,AB-,O+,O-	0 - 500
Type	Integer	Categorical/String	Integer	Categorical/String	Double
Missing records	0	1000	200	8000	0

Answer the below questions based on the above information.

a) For each Column above recommend with a valid reason, whether it should be considered for the training data or should be dropped. (5 Marks)

b) For each Column above recommend with a valid reason, what will be the pre-processing techniques that needs to be used before starting the training process. (10 Marks)

c) Recommend a Machine Learning algorithm that the developers can use for the prediction Model. (3 Marks)

d) If the client wants to predict the probability that the patient will have a heart attack instead of classifying, what would you recommend for the Algorithm. Justify your answer. (2 Marks)

Question 2 _____ (40 marks)

a) Briefly describe each of the following terms/ concepts using no more than five to six sentences.

i.	Vertical scaling and Horizontal scaling	(3 marks)
ii.	Platform Engineering	(3 marks)
iii.	Container Orchestration	(3 marks)
iv.	Shared Responsibility Model in Cloud	(3 marks)
v.	Continuous Integration and Delivery	(3 marks)

b) The CAP theorem states that it is impossible for a distributed system to simultaneously provide Consistency (C), Availability (A), and Partition Tolerance (P).

    i.   In the context of a data processing applications hosted on a cloud-based distributed system, suggest two separate example scenarios where Consistency (C) can be sacrificed, and Availability (A) can be sacrificed. **(5 marks)**

    ii.   You are tasked with designing an online reservation system for a famous restaurant chain that offers exclusive dining experiences. The restaurant is highly popular, with limited seating that gets fully booked within minutes of reservation slots opening. The system must be highly available to handle the surge in traffic during reservation windows, but it must also prevent double-booking tables beyond the restaurant's capacity. Using the CAP theorem as a guide, you need to manage the trade-offs between consistency and availability to ensure the system never overbooks, while still providing a smooth and responsive user experience.

(10 marks)

c) Both Monolithic and Microservices architecture styles provide efficient ways of building and managing applications given that they are used in the correct context.

    i.   Identify at least two potential issues that may arise when converting an already existing monolithic application to the microservice architecture. **(1 mark)**

    ii.   Differentiate monolithic and microservices architecture styles. **(2 marks)**

iii. Briefly explain the advantages that container orchestration platforms like Kubernetes would provide in deploying and managing microservices.   (2 marks)

iv. Considering the online reservation system described in question b (ii), justify how microservices architecture could be utilized for that scenario. As the chief architect, recommend the key design decisions you would make when using microservices architecture to build this system.   (5 marks)

Question 3   (20 marks)

a) Briefly explain the difference between "AR" and "VR".   (2 marks)

b) Analyze how the brain interprets the 3rd dimension in terms of "Binocular Vision" and "Cyclopean Image" using illustrations.   (7 marks)

c) Apply the information gathered from the analysis done in part (b), to briefly explain how the Stereoscopic Viewer invented by Sir Charles Wheatstone works to provide us with the sense of 3D. Use illustrations in aid of your answer.   (8 marks)

d) Using illustrations, explain the optical mechanism of a VR headset.   (3 marks)

Question 4   (20 marks)

a) "A blockchain based solution is not ideal for healthcare system where patient data needs to be securely stored and accessed only by authorized personnel." Do you agree with this statement? Justify your answer.   (7 marks)

b) 'Green Cart' is a company that manufactures and sells organic food products sourced from various farms. To ensure the authenticity and quality of its products, the company implements a blockchain-based supply chain tracking system. They have decided to keep track of details such as the type of crop, harvest date, location, and certifications (e.g., organic, fair trade). Create a sample block diagram (at least 3 blocks) with the minimum components needed for a blockchain.   (10 marks)

c) Briefly explain why Cryptographic Hash functions are fundamental for the immutability of blockchain.   (3 marks)