00138

Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Software Engineering

Final Examination
Year 4, Semester 1 (2024)

SE4010 – Current Trends in Software Engineering

Duration: 2 Hours

May 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) You are tasked with developing a machine learning model that is capable of identifying the type of an Iris flower based on the data provided. The data includes Sepal Length (cm), Sepal Width (cm), Petal Length (cm), Petal Width (cm) and plant height(cm). The dataset contains 150 rows of data.

Attribute	Data Type	Range of Values	Missing Values
Sepal Length (cm)	float64	4.3 to 7.9	0
Sepal Width (cm)	float64	2.0 to 4.4	5
Petal Length (cm)	float64	1.0 to 6.9	0
Petal Width (cm)	float64	0.1 to 2.5	0
Plant height (cm)	float64	10 to 100	90
Class	object	Iris Setosa, Iris Versicolour, Iris Virginica	0

one hot encoder use 1,0, label encoder replace the values with a given number
one hot prefer - logistic regression
label encoder - decision tree

Based on the provided summary of the dataset identify four (4) distinct pre-processing techniques that needs to be applied to the data before the data can be used for training. For each technique answer the following.

i. Pre-processing Technique (2 marks)

ii. Colum(s) to apply the technique on (4 marks)

iii. Justification (8 marks)

Preprocessing techniques
1. imputation - replace null values with not null values.
mean, median (), mode
2. one hot encoder , label encoder (categorical encoders) - add a value to identify
3. min max normalization and standardization (feature scale) -
4. outlier removal and transformation

b) You are going to participate in a generative AI competition. The task of the competition is to create a Digital Work of art by prompting the provided GenAI. Develop an effective prompt that would get you to win this competition. Justify what makes your prompt more effective. (6 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 ticketing system for a popular annual music festival that sees tens of thousands of attendees. The system requires high availability to handle peak ticket sales times effectively, but it must also prevent the sale of more tickets than the venue capacity. Interpret how you would design and architect this system with reference to the CAP theorem, focusing on the trade-offs between consistency and availability to ensure no overbooking occurs while maintaining a user-friendly ticket purchasing 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 ticketing 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)