CSA1092 Model 1 theory

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1. A software startup has been hired by an e-commerce company to

develop a personalized shopping assistant application. The client

expects the app to recommend products based on user behavior, allow

for social sharing, and have features that enhance user engagement.

However, the client is unsure about some specific functionalities and

wants the flexibility to add features as the project progresses. The

development team decides to use the Agile methodology to

accommodate the evolving requirements and involve the client

throughout the project.

a) Explain why Agile is an appropriate choice for this project.

What are the benefits of using Agile over a traditional Waterfall

approach.

b) Describe the role of the client in Agile. How does client

involvement at each sprint review improve the final product?

c) What are the potential challenges in managing multiple sprints?

Suggest strategies to keep the project on track and maintain

team productivity.

2. A banking institution is developing a fraud detection system for realtime transaction monitoring. Due to strict regulatory requirements and

the high stakes involved in preventing fraudulent transactions, the

system must be thoroughly tested for accuracy, security, and reliability.

The development team chooses the V-Model to ensure that each phase

of development has a corresponding testing phase, aligning with the

critical need for early defect detection and compliance verification.

a) Explain how the V-Model helps in early defect detection. Why

is this important for a system with high reliability requirements,

like fraud detection?

b) Compare the V-Model to Agile for this project. Why might

Agile be less suitable for a highly regulated project like a fraud

detection system?

c) How can the V-Model help in meeting regulatory compliance

requirements? Provide examples specific to a banking fraud

detection system.

3. Imagine a company is planning to launch a smart home security system

with AI-powered features, including facial recognition and automated

alerts. The product team is evaluating the feasibility of the project,

considering technical, operational, and financial aspects. However,

during the analysis, they identify several risks, such as high

development costs, potential privacy concerns, and limitations of facial

recognition technology in low-light conditions.

As a product manager, write a detailed report on how you would

approach these challenges. Include your strategies for mitigating risks,

ensuring compliance with privacy regulations, and maintaining the

financial viability of the product. Explain how user-centric design

principles can be applied to enhance the product’s appeal and address

ethical concerns.

4. A competitor launches a new feature that threatens your market

position, and stakeholders request prioritizing a similar feature midProgram Increment (PI).

1. Does delivering this feature align with the organization’s

strategic themes and portfolio goals?

2. How critical is it to maintaining market competitiveness?

3. What is the financial and reputational cost of not addressing

this immediately?

4. Can it wait until the next PI?

5. Which current PI objectives will be deprioritized to

accommodate this feature?

6. Will this impact overall business outcomes?

7. What is the potential business value of addressing this

competitive threat?

8. Will delaying it lead to revenue loss or customer churn?

5. A REST API (or GraphQL) backend for: Fetching inventory data from

a database. Updating stock levels when new products are added or

sold. Pushing low-stock alerts via Web Sockets or similar real-time

communication technology.

A front-end application using React (or Angular) for: Displaying

inventory data in a user-friendly and dynamic way. Implementing live

updates (e.g., stock counts) without requiring a full-page refresh.

Managing form inputs and error handling when adding or editing

inventory.

a) How would you architect the front-end and back-end

integration to ensure a smooth flow of real-time data?

b) Describe how you would structure the REST API or Graph QL

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schema to support the required operations (e.g., fetching,

updating, and real-time alerts).

c) What testing strategies would you employ to ensure the system

is robust and error-free?

6. Your team is tasked with containerizing a multi-service application for

deployment in a cloud environment. The application includes a frontend service built with React, a back-end service using Node.js, and a

PostgreSQL database.

You propose using Docker to containerize the services and Docker

Hub as the container registry. Your approach includes: Writing

optimized Dockerfiles for each service using multi-stage builds.

Managing images in Docker Hub with versioned tags for development,

staging, and production. Setting up Docker Compose for isolated local

development environments. Using a secret management tool to handle

sensitive environment variables (e.g., database credentials).

a) Why is it important to use multi-stage builds in your

Dockerfiles? How does it improve the performance, size, and

security of your images?

b) How does Docker Compose help in setting up isolated

development environments? Why is it essential for maintaining

consistency across development, staging, and production

environments?

c) How does the use of Docker images and registries prepare your

application for scalable deployment in cloud environments

(e.g., Kubernetes)? How does this approach reduce deployment

Complexity

7. Your company has decided to adopt a multi-cloud strategy for

deploying its web application using Docker containers. The team has

chosen Jenkins to set up the CI/CD pipeline but is facing challenges

with container orchestration, security, and scaling.

How would you design a CI/CD pipeline using Docker and Jenkins to

deploy the web application in a multi-cloud environment? What tools

and strategies would you implement to ensure scalability, security, and

consistent deployment across different cloud platforms?

8. An autonomous vehicle’s navigation software processes real-time

sensor data for decision-making. Sensor inputs include:

 GPS coordinates

 LIDAR scans

 Camera images

1. How would you use fuzz testing to simulate rare but possible

scenarios, such as conflicting sensor data (e.g., GPS shows a

clear path, but LIDAR detects an obstacle)?

2. How would you ensure that fuzz-generated inputs do not

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bypass critical safety checks, like collision detection?

9. You are tasked with managing a legacy inventory management system

for a large retail company. The system is over five years old, and while

it has been functional, technical debt has been accumulating over time.

The codebase is difficult to understand, and there are frequent

performance issues, especially when generating reports. The system

lacks automated tests, and parts of the code have been patched over

time to address urgent issues, leading to suboptimal design decisions.

The company is planning to expand its operations, and you need to

ensure the system can handle future growth.

a) Apply appropriate strategies to address the technical debt in this

legacy system.

b) Describe the specific steps you would take to refactor the

codebase, improve maintainability, and ensure the system can

scale effectively. Be sure to outline how you would incorporate.

c) Apply appropriate strategies to address the technical debt in this

legacy system.

d) Describe the specific steps you would take to refactor the

codebase, improve maintainability, and ensure the system can

scale effectively.

e) Be sure to outline how you would incorporate automated

testing and minimize disruption to ongoing operations during

this process.

10. You are part of a development team working on an IoT-based

healthcare application that collects data from wearable devices, such as

heart rate monitors and fitness trackers. The data needs to be processed

and analyzed in real time to provide actionable insights for users. The

team has decided to incorporate edge computing for faster data

processing, reducing latency. You are also exploring the use of AI/ML

to analyze health patterns and predict potential issues.

1. Justify why integrating edge computing for real-time data

processing and AI/ML for predictive analysis would be a

suitable approach for this healthcare application.

2. Describe how edge computing will impact data processing

speed, security, and privacy, and how AI/ML can enhance the

overall user experience in terms of accuracy and predictive

capabilities.