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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DIPLOMA IN SOFTWARE ENGINEERING

DSE 1007: SOFTWARE DEBUGGING AND INTEGRATION TESTING

DATE: 10TH DECEMBER, 2024
TIME: 11:30 AM-1:30 PM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY)AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

Case study: Restaurant Management System

You are part of a team developing a restaurant management system (RMS) with the following components: **Frontend** (Angular-based web application for managing orders, tables, and staff), **Backend** (A REST API built with Python (Django) for order processing, inventory tracking, and reporting), **Database** (PostgreSQL storing customer orders, inventory data, and staff schedules).

The team has encountered these issues:

- The frontend occasionally displays outdated order details.
- Inventory levels in the database are not updated correctly when orders are placed.
- Integration tests fail intermittently in the Continuous Integration/Continuous Delivery pipeline.

Questions:

a) Explain the purpose of debugging and how it applies to the issues raised above. **[5 Marks]**

b) Differentiate between unit testing and integration testing, and their applicability to the RMS case. **[4 Marks]**

c) Describe how you would apply **binary search debugging** to locate a bug in the backend order processing code of the RMS. **[4 Marks]**

d) How would you use **logging** to debug why the RMS frontend shows outdated order details? **[4 Marks]**

e) What is the **Top-Down Integration Testing** strategy, and how would you apply it in the RMS? **[4 Marks]**

f) Explain the significance of code coverage metrics in testing the RMS. **[4 Marks]**

g) Based on the issues in the RMS, suggest best practices to prevent such problems in the future. **[5 Marks]**

QUESTION TWO: [20 MARKS]

Case study: E-commerce application

A software development team is working on an e-commerce application. The application faces several issues such as; users occasionally experience failures during checkout, some products are missing or show incorrect inventory levels.

Questions:

a) Why is debugging critical in the development of an e-commerce application, and how can it help resolve the issues mentioned in the scenario? **[6 Marks]**

b) Which tool would you use for cross-browser testing of the e-commerce application frontend, and why? **[4 Marks]**

c) Design an integration test case for the e-commerce application checkout process. **[6 Marks]**

d) Explain how **delta debugging** could help identify the cause of the inconsistent test failures in the e-commerce application. **[4 Marks]**

QUESTION THREE: [20 MARKS]

Case study: Hotel booking system

A company is developing a hotel booking system with frontend, backend and database components. The following issues have been reported; The room availability status on the website is inconsistent with actual database records, Bookings are created but are not reflected in the user's booking history immediately, Integration tests for the payment gateway are failing intermittently.

Questions:

a) Define integration testing and explain its role in ensuring the quality of the hotel booking system. **[8 Marks]**

b) How does integration testing differ from system testing in the hotel booking system? **[6 Marks]**

c) Why is automating integration tests important for the hotel booking system? **[6 Marks]**

QUESTION FOUR: [20 MARKS]

Case study: Online banking system

A financial services company is developing an online banking system with the following components; **Frontend** (A React-based web application for users to view account details, transfer money, and pay bills), **Backend** (A microservices architecture with APIs for user authentication, transaction processing, and account management), **Third-Party Integrations** (APIs for bill payment, credit score retrieval, and fraud detection), **Database** (A MongoDB database for storing user information, account details, and transaction history). The system is in the testing phase, and the following issues have arisen:

- Transactions are occasionally delayed or fail without clear error messages.
- The fraud detection API returns inconsistent results, causing valid transactions to be blocked.
- Data synchronization between microservices is occasionally incorrect, leading to outdated account balances.

Questions:

a) How would the **Bottom-Up Integration Testing** strategy benefit online banking system? **[8 Marks]**

b) What are the risks of using the **Big Bang Integration Testing** approach in the online banking system? **[6 Marks]**

c) Explain how the **Sandwich Integration Testing** strategy can be applied to the online banking system. **[6 Marks]**

QUESTION FIVE: [20 MARKS]

Case study: E-commerce platform

A software development team is working on an e-commerce platform with the following modules; **Product Catalog** to display product details and stock levels, **Shopping Cart** to Manage items added by users and calculates totals, **Order Processing** to Handle payments, order confirmation, and stock updates, **Backend Services** (A REST API written in Python using Flask, connected to a PostgreSQL database). Several bugs have been reported such as; the **cart total** occasionally shows negative values, Products added to the cart are missing when users refresh the page, **Order confirmation emails** are not being sent reliably.

Questions.

a) What techniques would you use to identify the source of the negative cart total issue in the e-commerce platform? **[8 Marks]**

b) What automated tools could you use to debug the e-commerce platform? **[6 Marks]**

c) How would you create a debugging strategy to address all reported bugs in the e-commerce platform? **[6 Marks]**