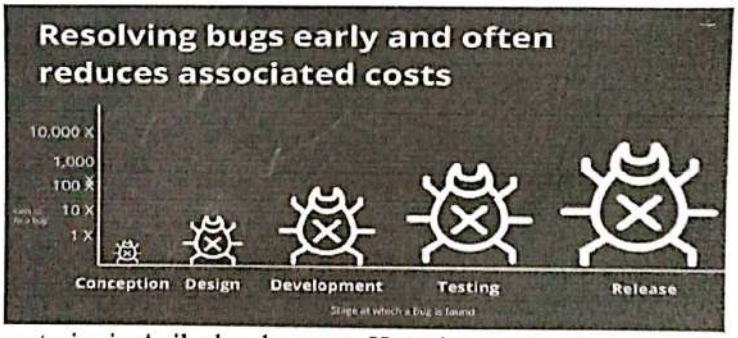
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UNIVERSITY OF BARISHAL
FINAL EXAMINATION
Course Title: Software Engineering and Information System Design
Course Code: CSE-3103
3rd Year 1st Semester
Session: 2021-22(Admission: 2019-20)

Time: 3 Hours **Marks:** 60

(Answer any FIVE questions)

1. a) Write down the principles that need to be followed during Software Development life cycle. [3]
   b) Imagine you are leading a software development team for a project with rapidly changing requirements. Which software process model would you recommend, and why? Provide a detailed explanation of how this model accommodates changes efficiently and ensures successful project delivery. [3]
   c) Compare and contrast the Incremental Model and Spiral Model. Highlight the key differences in their approach to development, risk management, and adaptability to changing requirements. Discuss scenarios where one model might be more suitable than the other. [3]
   d) Startups often operate in dynamic environments with limited resources. Discuss how established software process models can be tailored to suit the specific needs and constraints of startup projects. Provide recommendations and examples based on the Agile principles or other iterative models. [3]
2. a) The requirements engineering process is accomplished through the execution of seven distinct functions. Specifically, requirements engineering encompasses requirements elicitation, analysis, specification, verification, and management. Briefly describe these processes. [3]
   b) Differentiate between functional and non-functional requirements. Provide examples of each and discuss the significance of non-functional requirements in the development process. Explain how non-functional requirements impact system architecture and design. [3]
   c) Define people, process, and product. Explain the process quality and product quality in details. [2]
   d) Test early, test often. Prevention is better than the cure in software development. Justify your answer considering the following diagram. [2]



   e) Explain the concept of user stories in Agile development. How do user stories contribute to effective requirements management in an Agile environment? Discuss the characteristics of well-written user stories. [2]
3. a) Define design patter and code smells. Imagine you are tasked with designing the pricing system for an online shopping platform that sells a variety of products, ranging from **electronics to fashion items.** The platform wants to implement a flexible pricing system that can accommodate **different types of promotions and discounts**, allowing them to adapt their pricing strategy dynamically. To achieve this, the Strategy Design Pattern is considered an effective solution. Now implement the overall system with implementation code. [5]
   b) In the virtual pet simulation game, players have the opportunity to adopt and care for virtual pets that live in distinct habitats, ranging from lush jungles to icy tundras. Each habitat comes with its own set of challenges and interactions, and pets within the same habitat share common traits. The ..... will be employed to create families of related objects, ensuring that pets and habitats are created in a cohesive and interchangeable manner. What design pattern can be used to implement the system in details? [5]

c) Why singleton design pattern is used? Write down the reasons along with its implementation. [2

4. a) What do you mean by Code Smells and Refactoring? Define the concept of micro-services architecture in the context of web-based software design. Discuss the benefits and challenges of adopting a micro-services approach. Provide an example scenario where microservices would be advantageous. [3]

b) Write down the following code smells problems with solutions [3]
i. Feature Envy ii. Middle man iii. Shortgun Surgery iv. Refused Bequest v. Long method vi. Primitive obsession

c) Define Flaky test smells. Write short notes on Assertion Roulette, Magic Number, Eager Test, Sensitive Equality. [3]

d) Identify test smells in the following code snippets with detail explanation. [3]

i. "
```
public void test_2() throws Exception {
    String sql = "create database test_cascade for 'ALIYUN$test@aliyun.com' options(resourceType=ecu ecu_type=c1 ecu_count=2)";
    MySqlStatementParser parser = new MySqlStatementParser(sql);
    SQLStatement stmt = parser.parseStatement();
    String output = SQLUtils.toMySqlString(stmt);
    Assert.assertEquals("CREATE DATABASE test_cascade FOR 'ALIYUN$test@aliyun.com' OPTIONS (ecu_type=c1 ecu_count=2 resourceType=ecu )", output);
}"
```

ii. "
```
public void test_multimap() throws Exception {
    Map<String, Integer> map = ImmutableMap.of("a", 1, "b", 1, "c", 2);
    SetMultimap<String, Integer> multimap = Multimaps.forMap(map);
    Multimap<Integer, String> inverse = Multimaps.invertFrom(multimap, HashMultimap.<Integer, String>create());
    String json = JSON.toJSONString(inverse);
    assertEquals("{1:[\"a\",\"b\"],2:[\"c\"]}",json);
}"
```

iii. "
```
public void test_for_issue() throws Exception {
    ExtendedServletRequestDataBinder binder = new ExtendedServletRequestDataBinder(new Object());
    String json = JSON.toJSONString(binder);
    System.out.println(json);
    Assert.assertTrue(json.indexOf("$ref")>=0);
}"
```

5. a) What do you mean by testing? Do you think CMMI level is necessary? Justify your answer. [2]

b) Write short notes on: [4]
i. Reliability, Security, Downtime, authentication
ii. Error, bugs, mistakes, and faults
iii. Black Box, White Box, and Gray Box Testing

c) Define basic path testing and test case. How to find out the cyclometric complexity. [2]

d) In the realm of software development, articulate a concise definition of project management and delve into the distinctive qualities that set apart an exceptional project manager. Illustrate your response with a real-world example, demonstrating how these qualities contribute to the success of a software project. [4]

Scenario: Online Library Management System

Background:

The university recognizes the need for an efficient and modern Online Library Management System (OLMS) to enhance the overall management of its extensive collection of books, journals, and academic resources. The university library serves students, faculty, and librarians, each with distinct roles and responsibilities within the system.

The OLMS must address the following key requirements:

- User Authentication: Students, faculty, and librarians should have secure authentication mechanisms to access the system.
- Search and Filter Functionality: Users should be able to easily search and filter the library catalog to find books based on titles, authors, genres, or other relevant criteria.
- Borrowing and Returning: Users should be able to borrow books, and the system must keep track of borrowed items. A return mechanism should also be in place.
- Notification System: The system needs to have a notification feature to alert users about overdue items and related fines.
- Admin Functionalities: Librarians, as administrators, require functionalities to manage the library inventory, update the catalog with new acquisitions, and monitor system logs.

6. a) Briefly elaborate the overall scenario and find out the required requirements. [3]

b) Determine all required activity and swimlane diagram for the system. [4]

c) Draw the state and sequence diagram for the scenario. [5]

7. a) Find out all possible use case for the scenario along with use case diagram. [6]

b) Which type of software testing can be used to test the software with justification? [3]

c) Draw required data flow diagram for the system. [3]

8. a) Derive the potential classes from the user story in 6(a) with CRC class cards. [6]

b) Write down all possible test cases in detail for the system. [3]

c) Draw an E-R diagram for the system. [3]