SASTRA
DEEMED TO BE UNIVERSITY

School of Computing
End Semester Exam – May 2024
Course Code: CSE314R01 / CSE215
Course Name: Software Engineering Practices
Duration: 180 minutes Max Marks: 100

Answer the following question.

Q1. Assume an application for better delivery of Citizen Services in the village through computerization of applications like ***Online Patta (land authority) Transfer System*** **(OPTS)**, and ***Online Petition Monitoring System*** **(OPMS)**.

OPTS: Petition Processing Portal (E–district GDP) is an integral part of the district administration and the related departments in their day – to – day office work. OPMS is the customized version of E – district GDP for accepting applications and has the facility to record the petitions of different types of applications such as,

- Birth Certificate
- Death Certificate
- Community Certificate
- Pan Card

This service facilitates the public to submit petitions of their grievance and officers to process the applications and the senior officers to monitor and review the application processing.

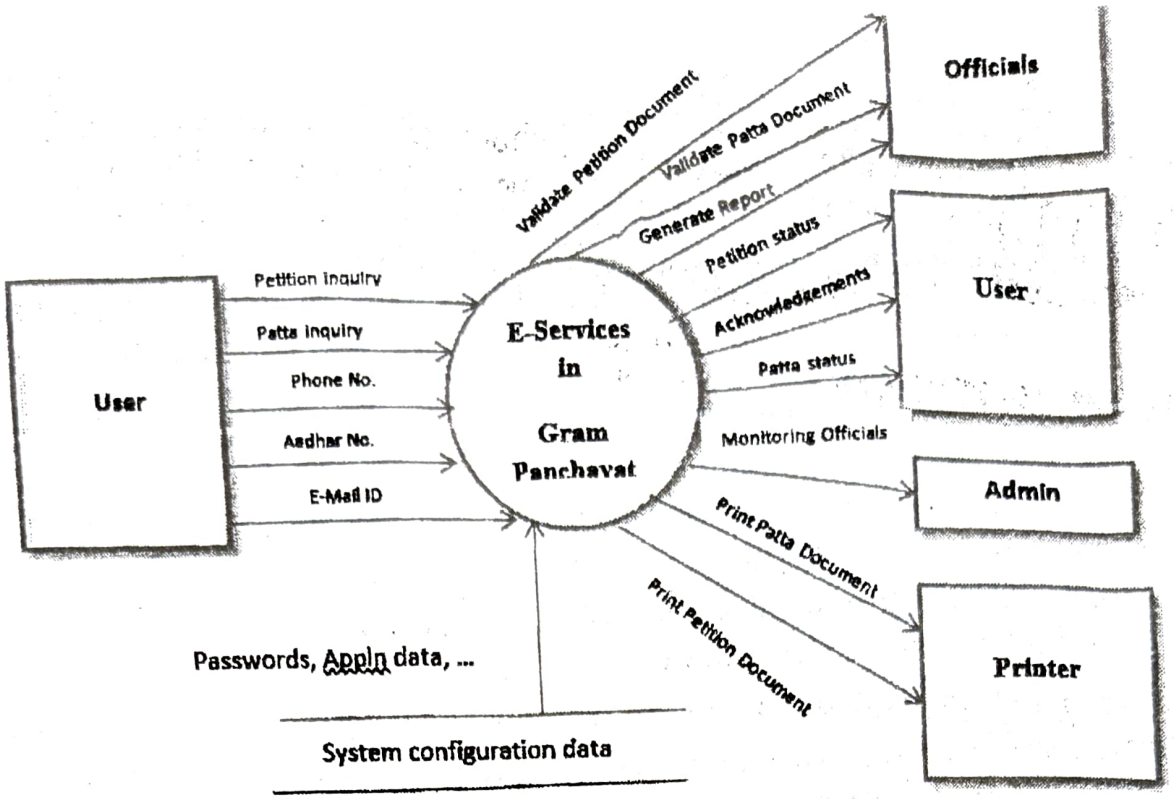
OPMS: This service enables the Online Patta Transfer for land parcels with options like ISD (Including Sub – Divisions) and NISD (Not Including Sub – Divisions). Status of each stage is intimated to the applicant via SMS and Patta Transfer order is generated in the system which is secured with 2D-Barcode. This proposed system provides transparency and integrity of data. These services enable people to track and view the status of the application at Collectorate Counters, Common Service Centres, ANYTIME ANYWHERE SYSTEMS. These services can be viewed and updated by the staff of the Gram Panchayat. The mutation that happened at registration department is reflected instantaneously through web services. These services are citizen centric and web enabled services using Open-Source Technologies. The project will be provided with new features every month to satisfy the customer requirements.

i) a. Having understood the given scenario, prepare the software requirement specification. (10)

b. Identify the appropriate process model for the given scenario and explain the model with proper justification. (15)

ii) a. Identify the potential classes which satisfies the criteria and draw an appropriate class diagram for the given scenario (15)

b. Consider the following data flow diagram:



Identify the information domain values and estimate the total FP by assuming that Σf_i = 50 with simple complexity. (10)

iii) a. Refine the analysis classes and elaborate the set of design classes (10)

b. Draw user interface design for online petition monitoring system and discuss the component level design steps for the given scenario. (15)

iv) a. Consider the following conditions for different modules:

Value conditions for ***adminLogin***:

- Aadhar Number should be valid unique 12-digit number
- E-Mail id should be valid one and ends with "@gmail.com"
- Taluk Code should be valid unique 6-digit code.

Value conditions for ***addOfficials***:

- Valid TNPSC GROUP IV marksheet should be attached
- AGE limit should be 21-42
- Experience in years should be in the range of 0-20.

Value conditions for ***removeOfficials***:

- Official ID should be valid unique 5-digit alphanumeric code.

Design test cases to verify these modules using boundary value analysis and equivalence partitioning for the given input domain. (15)

b. How will you perform partition testing and multiple class testing for the given problem statement? (10)

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Answer the following question.

Q2. In the wake of rapid urbanization, cities are facing multifaceted challenges ranging from traffic congestion, pollution, inadequate infrastructure, to inefficient resource management. To address these issues and propel towards sustainable development, there's an imperative need for the implementation of Smart City Systems. These systems integrate various technologies to optimize city operations, enhance quality of life, and foster economic growth. This system includes features like smart healthcare, governance, transportation, security surveillance, infrastructure, job opportunities, and amenities for comfortable living. This system requires iterative development, continuous improvement, and stakeholder collaboration throughout the development process.

i) a. As a member of the development team, which process model would you suggest for building a comprehensive smart city system. Justify your choice by explaining its phases and why you didn't opt for other models. (15)

b. Prepare a detailed software requirements specification document for the given scenario. (15)

ii) a. Compute the total estimated project cost and the estimated effort for building a smart city system based on the below LOC Estimates.

Function	Estimated LOC
Smart Healthcare Module	2800
Governance and Administration Module	5800
Transportation Management Module	6850
Security Surveillance Module	3750
Infrastructure Management Module	5400
Job Opportunities and Amenities Module	8600
Estimated Lines of Code	**33200**

A review of historical data indicates that the organizational average productivity for systems of this type is 620 LOC/pm. It is also known that the labor rate is 8,000/-Rs per month. (5)

b. List the functions performed by the primary actor of a smart city system designed to incorporate all amenities for comfortable living. Elaborate on one of the use cases using appropriate modeling techniques. (15)

iii) a. Identify potential classes for the smart city system and create an analysis class diagram. Transform the analysis classes into design classes. Then, draw the Architectural Contextual Diagram (ACD) of the system (5 + 5 + 5)

b. Create a flow graph for the given program:

```
1.  if (violationType == 1) {
2.  if (severity == 1)
3.  penaltyAmount = 100;
4.  else if (severity == 2)
5.  penaltyAmount = 200;
6.  else if (severity == 3)
7.  penaltyAmount = 300;
8.  else {
9.  printf("Invalid severity level\n");
10. return 1;
11. }
12. } else if (violationType == 2) { // Red light violation
13. if (severity == 1)
14. penaltyAmount = 150;
15. else if (severity == 2)
16. penaltyAmount = 250;
17. else if (severity == 3)
18. penaltyAmount = 400;
19. else {
20. printf("Invalid severity level\n");
21. return 1;
22. }
23. }
```

Calculate its cyclomatic complexity and identify the independent paths. (15)

iv. a. The proposed system should incorporate sensors for measuring air quality, noise levels, temperature, humidity, and light intensity. Each sensor should provide numeric input values within specified ranges:

Air Quality Sensor: Air quality index (AQI) range: 0 to 500
Noise Level Sensor: Noise level range: 0 dB to 120 dB
Temperature Sensor: Temperature range: -20°C to 50°C
Humidity Sensor: Humidity range: 0% to 100%

Design test cases to verify the sensor functioning using Boundary Value Analysis and Equivalence Partitioning Testing Techniques. (5+5)

b. Identify the suitable test cases for conducting class-level testing for any one of the identified classes. (10)

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Answer the following question.

Q3. Journey Junkies, a popular travel agency, not only provides solutions for personal travel but also works on your professional travel needs. Whether it is a short trip or an office off-site, the travel agency needs to arrange it. They plan to expand their business by having an online portal, www.journeyjunkies.com. This would be a hotel management portal that allows hotel bookings to be made online. The portal allows users to search for and book hotels online. A user can search by date, hotel, room type, price, location, and number of people. Real-time room availability checks and automatically updates inventory as rooms are booked. The system features a payment gateway system to process their bookings in real time. Hotels can be notified of bookings by email or fax as required. Users can log in and review or update their booking details or cancel their booking. Through the Room Management System module, Hotels can log in and update their Rates, Room Availability, Room types and descriptions, Check-in / Checkout Time, Discount types: group, student, long stay, Cut Offs, Minimum Stays, Room occupants, Blocked rooms, Hotel information and description, Tax management, Commission management, Optional extras (meals, airport pickup, tours, etc.). The booking form can have options for price per room per night, per person per night, per person per booking, or booking. With the Reservation Management module, Hotels can view their reservations by date and cancel reservations. The system can also extend its functionality using live chatbots for booking. This sends an email to the travel portal and the guest. The system provides various reports, such as Rates for a given hotel/room type, Current Discounts, Availability, monthly sales, sales summary, and sales analysis.

i) a. Having a thorough understanding of the set of general objectives of the software but, still there is a need to identify detailed requirements for functions and features, select an appropriate software process model suitable for the above scenario. (15)
b. Prepare the software requirements specification report for the given scenario. (10)

ii) a. Illustrate the above scenario using class diagram. Also expand one of the functionalities of the software using activity diagram. (15)
b. The software is described using 5 use cases with 7 transactions, 3 use cases with 8 transactions and 7 use cases with 6 transactions. Three actors of the software interact with system using GUI, 4 actors using well-defined API and 4 actors using protocol. The technical complexity factor is 1.02 and environment factor is 0.76. Compute use case points of the software. A review on the historical data indicates that the

organizational average productivity for systems of this type is 3 UCP/pm. Based on a burdened labor rate of Rs.18,000/- per month, compute the total cost to develop software and estimate the effort in person month. (10)

iii) a. Neatly sketch the architecture diagram of the software using appropriate architectural style. Justify the reason for style chosen. (10)

b. Identify and illustrate all the components through a component-based diagram and create an attractive user interface design. (15)

iv) a. From the description of the software, it is observed that the hotel booking is to be made online. Identify any two Black Box testing and write the suitable test case for the application. (15)

b. Create collaboration diagram for the above application. Conduct multiclass testing of the software with suitable test cases. (10)

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Answer the following question.

Q4. The implications of utilizing autonomous vehicles in everyday use will exponentially reduce the negative impacts on society caused by manual transportation. Implementation and usage of Autonomous vehicles leads to some effects such as infrastructural changes, the manufacturing costs, development/research costs, consumer costs, development time, and the desirability of the system. Desirability is defined as how likely the public is to accept the changes brought by autonomous personal transportation. Heavy rainfall interferes with sensors, and snow on the ground makes it hard for vehicles to read lines on the road. All the little mistakes that Google Maps or Siri make will need to be taken care of, too.

On the other hand, the implications will cause a resulting impact on personal safety during travel, efficiency and productivity of individuals and businesses. As a result of autonomous transportation economics, availability and accessibility to passengers with handicaps or less independence. This will make a huge change in society. The goal of this project is to make an autonomous self-driving car, capable of maneuvering around bends, avoiding obstacles and following traffic signals and road signs. On the other hand, the implications will cause a resulting impact on personal safety during travel, efficiency and productivity of individuals and businesses. As a result of autonomous transportation economics, availability and accessibility to passengers with handicaps or less independence. CNN is the primary algorithm that these systems use to recognize and classify different parts of the road, and to make appropriate decisions. Self-driving cars are autonomous decision-making systems. They can process streams of data from different sensors such as cameras, LIDAR, RADAR, GPS, or inertia sensors. This data is then modelled using deep learning algorithms, which then make decisions relevant to the environment the car is in.

The main modules are RADAR - Radio Detection and Ranging uses radio waves for ranging. RADAR signals are reflected especially well by materials that have considerable electrical conductivity, such as metallic objects. The main benefits of RADAR are to find the distance between objects. The second module is LIDAR- Light Detection and Ranging uses light in the form of a pulsed laser. LIDAR sensors send out 50,000 - 200,000 pulses per second to cover an area and compile the returning signals into a 3D point cloud. It is used to detect the movement of objects. The third module is Camera

spotting things like lane lines on the highway, speed signs, and traffic lights. And the last module is GPS. It is used to get the location details and find the best path from google map.

i) a. Identify suitable process model with proper justification. (15)

b. Presume that you are an attendee in a collaborative requirements gathering. Prepare a list of objects, services, performance criteria, and constraints of the software for gathering the requirements of the above scenario. (10)

ii) a. You have been asked to develop an embedded application for the above software. Use Putnam and Myer's equation to calculate the effort required to complete the software if the total LOC is equal to 13000. Compare the results with software equation by assuming t_{min} as 5 months. (10)

b. Analyze the given scenario, identify the primary actors of the software, list the functionalities performed by the primary actor. Elaborate any of the functionalities using use case template. (15)

iii) a. Which architecture style is suitable for the given scenario? Justify your answer and explain the chosen architecture style. (15)

b. Draw the architectural context diagram of the software. Define and elaborate the archetypes of the software. Refine the architecture into components (10)

iv) a. Construct flow graph for the algorithm given below. Perform the basis bath testing and calculate cyclomatic complexity. Also write the basis path sets.

1. Read steering value
2. If steering value <=0
3. Error
4. Else
5. Do adjustment
6. Capture right camera, left camera and centre camera values goto step 10
7. If blur picture
8. Preprocess
9. Apply CNN and predict the value
10. Calculate back propagation weight and correct the CNN predicted value
11. After predicted value move the car

b. How would you perform object-oriented testing for this project? Explain and write suitable test cases. (10)