

# Q1. Key Classes, Attributes, and Functionalities

## 1. AutomatedFraudDetectionSystem (Central Controller)

**Role:** Acts as the main orchestrator of the system. It manages transaction processing, risk evaluation, decision making, and alert generation.

**Key Attributes:**

- systemId
- systemStatus (Active / Maintenance / Fail-safe)

**Key Methods:**

- processTransaction()
- calculateRiskScore()
- approveTransaction()
- blockTransaction()

## 2. User (Base Class)

**Role:** Abstract parent class representing all human users interacting with the system.

**Key Attributes:**

- userId
- username
- password (Encrypted)

**Key Methods:**

- login()
- logout()

## 3. BankCustomer (Inherits from User)

**Role:** Represents a bank customer who performs financial transactions and receives fraud alerts.

**Key Attributes:**

- accountNumber
- registeredDevices

**Key Methods:**

- initiateTransaction()
- receiveAlert()

## 4. SystemAdmin (Inherits from User)

**Role:** Responsible for system configuration, fraud rule management, and AI model control.

**Key Attributes:**

- adminId
- accessLevel

**Key Methods:**

- manageRiskRules()
- manageAIModels()
- generateComplianceAudit()

## 5. FraudAnalyst (Inherits from User)

**Role:** Handles manual investigation and review of suspicious transactions.

**Key Attributes:**

- analystId
- assignedCases

**Key Methods:**

- investigateTransaction()
- approveOverride()
- labelTransaction()

## 6. Transaction

**Role:** Represents a financial transaction submitted for fraud analysis.

**Key Attributes:**

- transactionId
- userId
- amount
- timestamp
- merchantId
- deviceId
- ipAddress

**Key Methods:**

- getTransactionDetails()
- validateTransaction()

## 7. TransactionMonitor

**Role:** Continuously monitors transaction flow and user behavior in real time.

**Key Attributes:**

- monitoringStatus
- transactionQueue

**Key Methods:**

- monitorTransaction()
- detectAnomaly()

## 8. RiskScoringEngine

**Role:** Calculates fraud risk score using rules, machine learning, and behavioral analysis.

**Key Attributes:**

- riskThresholdLow
- riskThresholdMedium
- riskThresholdHigh

**Key Methods:**

- computeRiskScore()
- classifyRiskLevel()

## 9. RuleEngine

**Role:** Applies predefined fraud detection rules and heuristics.

**Key Attributes:**

- ruleSet
- ruleVersion

**Key Methods:**

- evaluateRules()
- updateRules()

## 10. MLModelManager

**Role:** Manages machine learning models for adaptive fraud detection.

**Key Attributes:**

- modelVersion
- trainingDataSet

**Key Methods:**

- predictFraudProbability()
- retrainModel()

## 11. AlertManager

**Role:** Sends real-time alerts and notifications to users and administrators.

**Key Attributes:**

- alertChannel (SMS / Email / Push)

**Key Methods:**

- sendRealTimeAlert()
- notifyCustomer()

## 12. ExternalFraudDatabase

**Role:** Integrates external fraud intelligence sources for enhanced detection.

**Key Attributes:**

- apiEndpoint
- apiKey

**Key Methods:**

- queryFraudPatterns()
- fetchBlacklistData()

## 13. DashboardAndReports

**Role:** Displays fraud analytics, statistics, and compliance reports.

**Key Attributes:**

- fraudMetrics
- reportData

**Key Methods:**

- displayDashboard()
- generateReport()