AI Development Workflow Assignment

Part 1: Short Answer Questions

1. Problem Definition

Hypothetical AI Problem: Predicting student dropout rates.

Objectives:

- Identify at-risk students early.
- Improve student retention.
- Provide targeted intervention programs.

Stakeholders: Students, School Administration.

KPI: Prediction accuracy and reduced dropout rate percentage.

2. Data Collection & Preprocessing

Data Sources: Student academic records, Attendance data.

Potential Bias: Biased representation of students from different socioeconomic backgrounds.

Preprocessing Steps:

- Handle missing values.
- Normalize numerical features.
- Encode categorical variables.

3. Model Development

Chosen Model: Random Forest (robust and handles mixed data types).

Data Split: 70% training, 15% validation, 15% test.

Hyperparameters: Number of trees (improves stability), max depth (prevents overfitting).

4. Evaluation & Deployment

Evaluation Metrics: Accuracy (overall correctness), F1-score (balance between precision & recall).

Concept Drift: Change in dropout behavior over time; monitor using periodic retraining & performance tracking.

Technical Challenge: Scalability with increasing student data.

Part 2: Case Study Application (Hospital Readmission Prediction)

1. Problem Scope

Problem: Predict patient readmission within 30 days.

Objectives: Reduce readmissions, improve care quality.

Stakeholders: Patients, Doctors, Hospital Admin.

2. Data Strategy

Data Sources: Electronic Health Records, Demographics.

Ethical Concerns: Patient privacy, data consent.

Preprocessing & Feature Engineering:

- Clean missing medical fields.

- Normalize lab values.

- Engineer features (age groups, past admission history).

3. Model Development

Model: Gradient Boosting (works well with tabular health data).

Confusion Matrix Example:

TP=80, FP=20, FN=30, TN=70

Precision = 80/(80+20) = 0.80

Recall = 80/(80+30) = 0.73

4. Deployment

Steps:

- Integrate with hospital EHR system.

- Create API for predictions.

- UI dashboard for doctors.

Regulatory Compliance: HIPAA — data encryption, secure servers, audit logs.

5. Optimization

Method to reduce overfitting: Cross-validation.

Part 3: Critical Thinking

1. Ethics & Bias

Biased data may cause unequal treatment recommendations.

Strategy: Balanced sampling & fairness metrics.

2. Trade-offs

Interpretability vs accuracy — simpler models easier to justify in healthcare.

Limited compute → choose logistic regression over deep learning.

Part 4: Reflection & Workflow Diagram

Reflection: Data preprocessing was hardest due to complexity.

Improvement: Use automated ML pipelines.

Flowchart:

Problem Definition → Data Collection → Preprocessing → Model Training → Evaluation → Deployment → Monitoring