Assignment-2:
Fairness and Bias in Predictive Modeling

The goal of this assignment is to give you hands-on experience in building predictive models, while considering and addressing fairness and bias issues in real-world data. You are expected to learn how to identify potential sources of bias in datasets, evaluate model performance not just overall but across different demographic or protected groups, and implement corrective measures to mitigate unfairness, such as feature elimination, reweighting, or calibration. Overall, the assignment aims to develop your ability to critically analyze the ethical and practical implications of machine learning models, make informed decisions about model design, be able to train a model, assess both its accuracy and fairness, and apply strategies to create more equitable predictions.

Deadline: 05-September-2025, 2359 hrs; late submissions penalized 10% every calendar day.

What to do:
1. Work in pairs.
2. Pick a dataset based on the algorithm below.
   - Add the last digit from each of your roll numbers.
   - If the sum is even, Predict Students' Dropout and Academic Success
   - Else, use Absenteeism at work
3. Train a simple model for your selected task; you may use libraries such as scikit-learn, pandas, numpy, etc.
4. Before training, conduct a bias evaluation:
   - Identify potential biases in the dataset (sampling, historical, labeler, measurement, etc.), identify its source.
   - Analyze whether certain groups are over- or under-represented or disproportionately affected, and how you can address it.
5. Implement corrective measures, to mitigate bias. Examples include:
   - Feature elimination: Remove features that encode sensitive attributes or proxies
   - Reweighting or resampling to balance representation
   - Calibration techniques to adjust predictions across groups
6. Fairness Evaluation:
   - Evaluate your model's performance overall and across subgroups.
   - Use metrics such as accuracy, precision, recall, F1 score as appropriate.
   - Use fairness metrics (e.g., statistical parity, equal opportunity), justify them.
7. Document these metrics before and after implementing corrective measures.

What to turn in?
1. Python Implementation:
   o Use Colab or provide a GitHub repository link.
   o Include all code required to reproduce your results; provide a docker to make this easy.
   o Document your code well; this is graded.
2. Report:
   o Summarize your dataset, model choice, evaluation metrics, bias/fairness analysis, and corrective measures.
   o Discuss how corrective measures changed performance and fairness – use graphs, numbers, etc. to tell this story.
   o Clearly mention contributions of each person.
   o Submit the report link on HelloIITK, as a single PDF.

Tips:
1. Treat this as a story telling exercise – makes for much clearer report, and systematic work.
2. Make sure you both write code, and it shows on GitHub.
3. Happy coding!