**Refer this solutions document only after solving “Helpful Exercise - Questions”**

1. Run the **subsections** **3.3** (learning RF classifier on original data) and **4.3** (learning RF classifier on data transformed by reweighing) and compare the results with the corresponding ones for Logistic Regression (LR) classifier. How effective is reweighing preprocessing on RF compared to LR classifier with respect to best balanced accuracy, 1-min(DI, 1/DI) and average odds difference measures?

*The reweighing pre-processing is less effective with RF classifier compared to the LR classifier, since it does not bring 1-min(DI, 1/DI) and average odds difference measures close to 0. Pre-processing with LR was more effective with these measures. The RF classifier trained with reweighed data mostly preserves the balanced accuracy compared to the one trained with the original data.*

1. Rerun the cells in **Section 4.3** five times without restarting the notebook every time. Observe and record what happens to the best balanced accuracy, 1-min(DI, 1/DI) and average odds difference measures on test data over the five trials.

*The variation in the measures are not very appreciable over the five trials.*

***Sample results for 5 runs (may be different for other people running this):***

*Threshold corresponding to Best balanced accuracy: 0.2300*

*Best balanced accuracy: 0.7644*

*Corresponding 1-min(DI, 1/DI) value: 0.4490*

*Corresponding average odds difference value: -0.1126*

*Corresponding statistical parity difference value: -0.1855*

*Corresponding equal opportunity difference value: -0.1004*

*Corresponding Theil index value: 0.0943*

*Threshold corresponding to Best balanced accuracy: 0.2400*

*Best balanced accuracy: 0.7609*

*Corresponding 1-min(DI, 1/DI) value: 0.4387*

*Corresponding average odds difference value: -0.0968*

*Corresponding statistical parity difference value: -0.1722*

*Corresponding equal opportunity difference value: -0.0797*

*Corresponding Theil index value: 0.0956*

*Threshold corresponding to Best balanced accuracy: 0.2200*

*Best balanced accuracy: 0.7646*

*Corresponding 1-min(DI, 1/DI) value: 0.4319*

*Corresponding average odds difference value: -0.1120*

*Corresponding statistical parity difference value: -0.1839*

*Corresponding equal opportunity difference value: -0.1016*

*Corresponding Theil index value: 0.0939*

*Threshold corresponding to Best balanced accuracy: 0.2200*

*Best balanced accuracy: 0.7674*

*Corresponding 1-min(DI, 1/DI) value: 0.4295*

*Corresponding average odds difference value: -0.1085*

*Corresponding statistical parity difference value: -0.1829*

*Corresponding equal opportunity difference value: -0.0952*

*Corresponding Theil index value: 0.0928*

*Threshold corresponding to Best balanced accuracy: 0.2400*

*Best balanced accuracy: 0.7600*

*Corresponding 1-min(DI, 1/DI) value: 0.4486*

*Corresponding average odds difference value: -0.1019*

*Corresponding statistical parity difference value: -0.1787*

*Corresponding equal opportunity difference value: -0.0819*

*Corresponding Theil index value: 0.0959*

1. Set the hyperparameters n\_estimators=50 and min\_samples\_leaf=2 when creating the RF pipeline in **Section 4.3.1**.

Now repeat question ‘B’ in this document

With respect to the three measures, compare the stability of the original hyperparameter setting to the new hyperparameter setting. If we were to deploy this bias-mitigated classifier on a new test set, which hyperparameter setting should be used, and why?

*Results vary appreciably over the five trials, particularly with respect to 1-min(DI, 1/DI) and average odds difference measures. The variation in best balanced accuracy is lesser. This higher variance is likely due to the small number of samples in each leaf of the trees and the small number of trees in the forest. It is preferable to choose the original hyperparameter setting with new test data since the higher variation with the new parameter setting will make the deployment unreliable.*

***Sample results for 5 runs (may be different for other people running this):***

*Threshold corresponding to Best balanced accuracy: 0.2100*

*Best balanced accuracy: 0.7531*

*Corresponding 1-min(DI, 1/DI) value: 0.4456*

*Corresponding average odds difference value: -0.1304*

*Corresponding statistical parity difference value: -0.2021*

*Corresponding equal opportunity difference value: -0.1149*

*Corresponding Theil index value: 0.0960*

*Threshold corresponding to Best balanced accuracy: 0.2200*

*Best balanced accuracy: 0.7536*

*Corresponding 1-min(DI, 1/DI) value: 0.3668*

*Corresponding average odds difference value: -0.0627*

*Corresponding statistical parity difference value: -0.1529*

*Corresponding equal opportunity difference value: -0.0199*

*Corresponding Theil index value: 0.0930*

*Threshold corresponding to Best balanced accuracy: 0.2300*

*Best balanced accuracy: 0.7718*

*Corresponding 1-min(DI, 1/DI) value: 0.3941*

*Corresponding average odds difference value: -0.0946*

*Corresponding statistical parity difference value: -0.1593*

*Corresponding equal opportunity difference value: -0.0994*

*Corresponding Theil index value: 0.0919*

*Threshold corresponding to Best balanced accuracy: 0.3000*

*Best balanced accuracy: 0.7499*

*Corresponding 1-min(DI, 1/DI) value: 0.4309*

*Corresponding average odds difference value: -0.0667*

*Corresponding statistical parity difference value: -0.1399*

*Corresponding equal opportunity difference value: -0.0497*

*Corresponding Theil index value: 0.1020*

*Threshold corresponding to Best balanced accuracy: 0.2300*

*Best balanced accuracy: 0.7652*

*Corresponding 1-min(DI, 1/DI) value: 0.4165*

*Corresponding average odds difference value: -0.1005*

*Corresponding statistical parity difference value: -0.1654*

*Corresponding equal opportunity difference value: -0.1018*

*Corresponding Theil index value: 0.0956*