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Step 1

Dataset: Student Alcohol Consumption (https://www.kaggle.com/datasets/uciml/student-alcohol-consumption?select=student-mat.csv)

- **Note:** I transformed the values within the ***sex*** column from **F (Female)** and **M (Male)** to **0** and **1** respectively for fairness metric calculations.

Regulated Domain: Education (Education Amendments of 1972; Civil Rights Act of 1964)

Observation: 649

Variables: 33

Dependent Variables: 3; ***Dalc*** *(workday alcohol consumption),* ***Walc*** *(weekend alcohol consumption),* and ***absences*** *(# of school absences)*

How many and which variables in the dataset are associated with a legally recognized protected class? Which legal precedence/law (as discussed in the lectures) does each protected class fall under?

Number of Protected Class Variables: 2

Variable	Protected Class	Law
sex	Sex	(Equal Pay Act of 1963; Civil Rights Act of 1964, 1991)
age	Age	Age Discrimination in Employment Act of 1967) (over 40

Step 2

Step 2.1:

Protected Class	Membership Categories
Sex	0 (Female), 1 (Male)
Age	Under 18, 18 and Over

Step 2.2:

Dependent Variable	Very Low	Low	Average	High	Very High
dalc	1	2	3	4	5

Dependent Variable	Very Low	Low	Average	High	Very High
walc	1	2	3	4	5

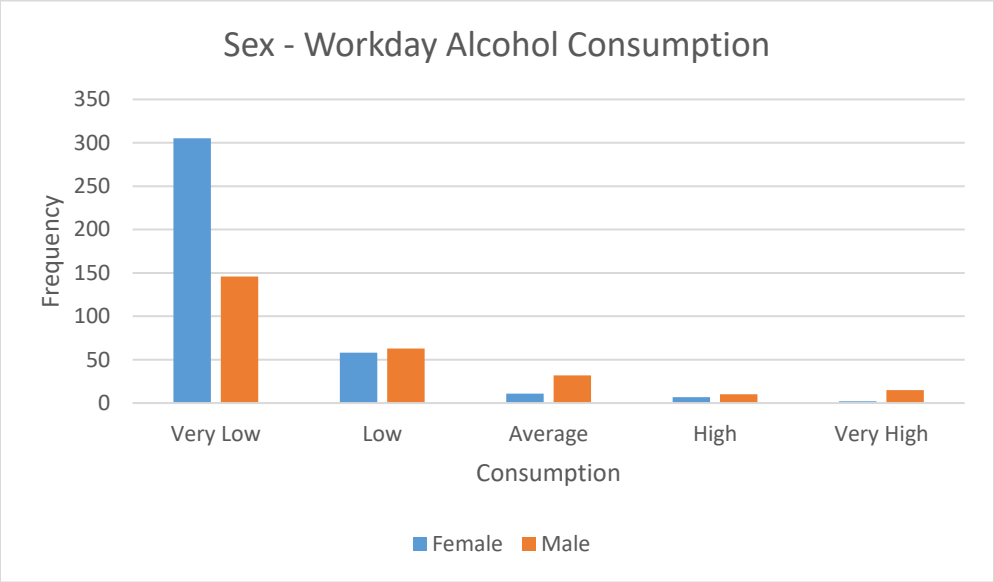
Dependent Variable	Low	High
absences	0 - 16	17 - 32

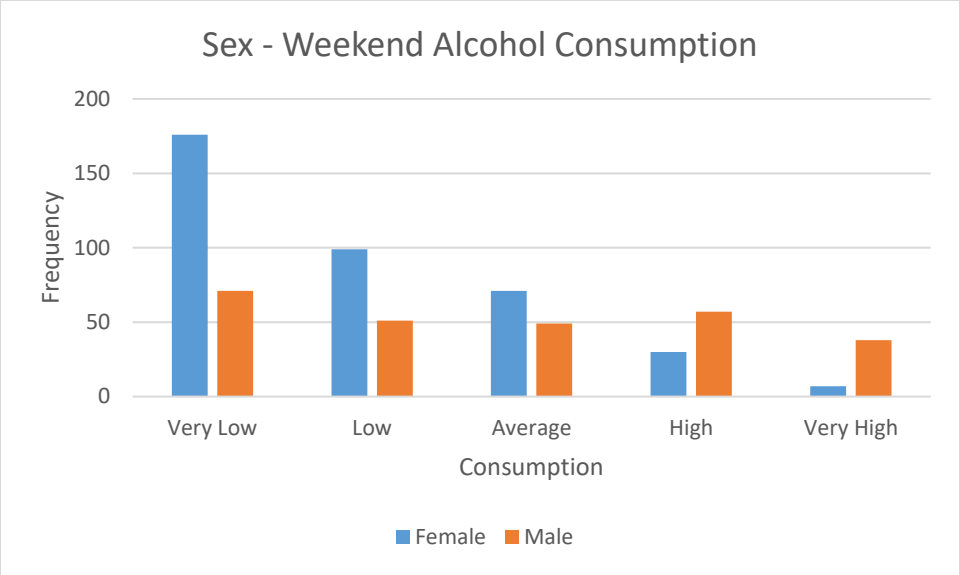
Step 2.3:

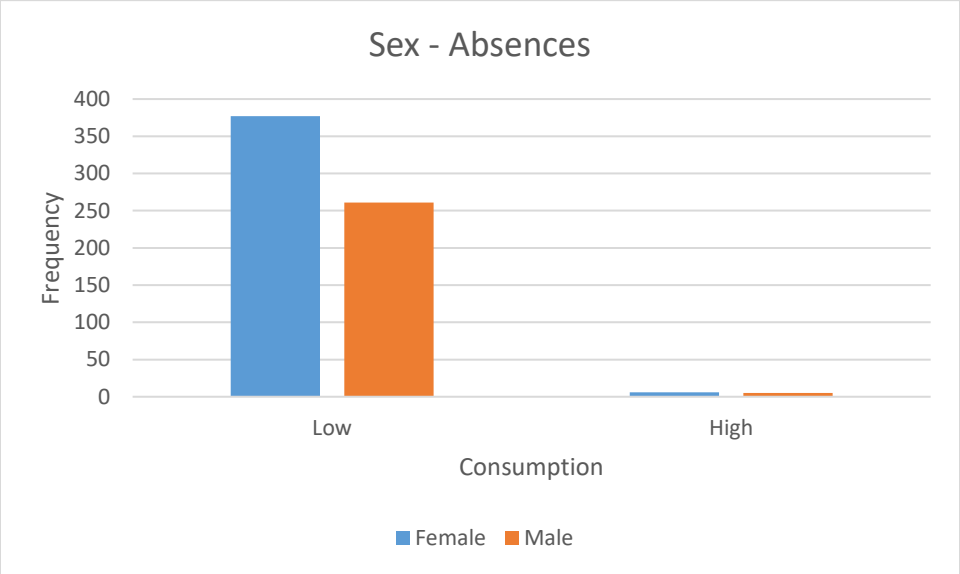
Protected Class	Frequency of Membership Categories
Sex	0 (Female) – 383 1 (Male) – 266
Age	>18 (Under 18) – 468 <=18 (18 and Over) – 181

Step 2.4:

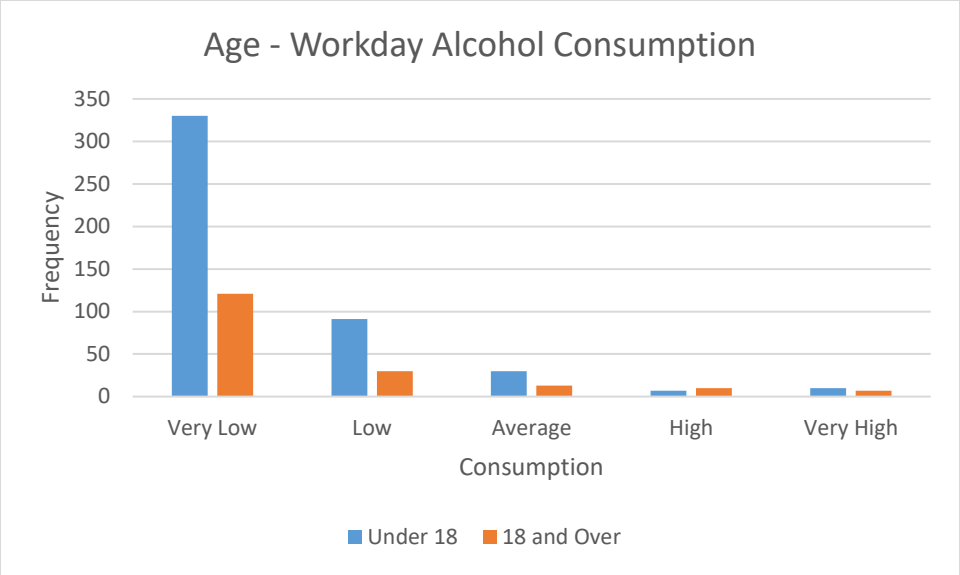
Protected Class - Sex	Variable - Dalc	Variable - Walc	Variable - Abscences
Sex: 0 (Female)	**Very Low:** 305 **Low:** 58 **Average:** 11 **High:** 7 **Very High:** 2	**Very Low:** 176 **Low:** 99 **Average:** 71 **High:** 30 **Very High:** 7	**Low:** 377 **High:** 6
Sex: 1 (Male)	**Very Low:** 146 **Low:** 63 **Average:** 32 **High:** 10 **Very High:** 15	**Very Low:** 71 **Low:** 51 **Average:** 49 **High:** 57 **Very High:** 38	**Low:** 261 **High:** 5

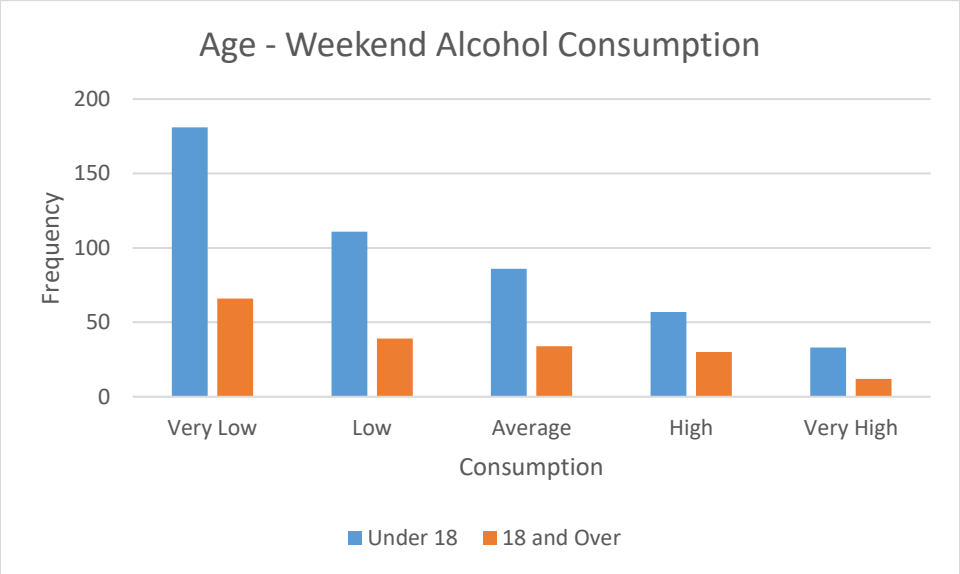


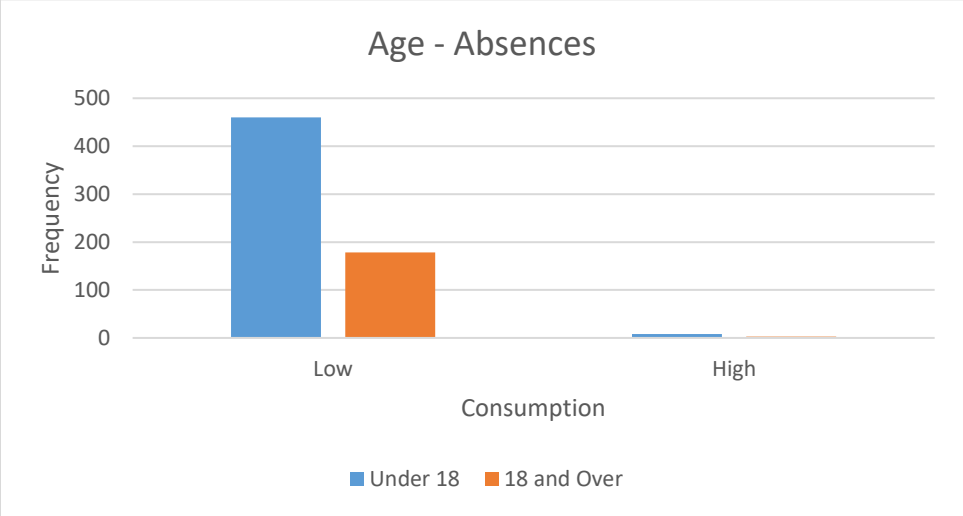




Protected Class - Age	**Variable - Dalc**	**Variable - Walc**	**Variable – Abscences**
Age: >18 (Under 18)	**Very Low:** 330 **Low:** 91 **Average:** 30 **High:** 7 **Very High:** 10	**Very Low:** 181 **Low:** 111 **Average:** 86 **High:** 57 **Very High:** 33	**Low:** 460 **High:** 8
Age: <=18 (18 and Over)	**Very Low:** 121 **Low:** 30 **Average:** 13 **High:** 10 **Very High:** 7	**Very Low:** 66 **Low:** 39 **Average:** 34 **High:** 30 **Very High:** 12	**Low:** 178 **High:** 3


Age - Workday Alcohol Consumption
350
300
250
200
150
100
50
0
Frequency
Very Low
Low
Average
High
Very High
Consumption
Under 18
18 and Over


Age - Weekend Alcohol Consumption
200
150
100
50
0
Frequency
Very Low
Low
Average
High
Very High
Consumption
Under 18
18 and Over


Age - Absences
500
400
300
200
100
0
Frequency
Low
High
Consumption
Under 18
18 and Over

Step 3

Step 3.1 - 3.2

***Note: Threshold** values for both dependent values is **3** (**favorable** outcomes are variables **<=3**, **unfavorable** outcomes are **>3**)

Protected Class	Sex
Dependent Variable	Dalc
Privileged Group	Female (383)
Unprivileged Group	Male (266)
Original Disparate Impact	0.927818
Original Statistical Parity Difference	-0.070486

Protected Class	Sex
Dependent Variable	Walc
Privileged Group	Female (383)
Unprivileged Group	Male (266)
Original Disparate Impact	0.711602
Original Statistical Parity Difference	-0.260537

Protected Class	Age
Dependent Variable	Dalc
Privileged Group	Under 18 (468)
Unprivileged Group	18 and Above (181)
Original Disparate Impact	0.940231
Original Statistical Parity Difference	-0.057598

Protected Class	Age
Dependent Variable	Walc
Privileged Group	Under 18 (468)
Unprivileged Group	18 and Above (181)
Original Disparate Impact	0.950802
Original Statistical Parity Difference	-0.039737

Step 3.4

Protected Class	Sex
Dependent Variable	Dalc
Pre-Processing Algorithm	Reweighting
Mitigated Disparate Impact	1.000000
Mitigated Statistical Parity Difference	0.000000

Protected Class	Age
Dependent Variable	Dalc
Pre-Processing Algorithm	Reweighting
Mitigated Disparate Impact	1.000000
Mitigated Statistical Parity Difference	0.000000

Step 4 – Option A

Protected Class	Sex
Privileged/Unprivileged Groups	0 (Female) / 1 (Male)
Dependent Variable	Dalc
Original Dataset	
Disparate Impact	0.8958
Statistical Parity Difference	-0.1042
Transformed Dataset	
Disparate Impact	1.0811
Statistical Parity Difference	0.0721

Fairness Metric: *Disparate Impact*

Original Fairness Outcome	Transformed Outcome	Change
0.927818	1.000000	Positive

Original Fairness Outcome	Classifier – Original Outcome	Change
0.927818	0.8958	Negative

Original Fairness Outcome	Classifier – Transformed Outcome	Change
0.927818	1.0811	Positive

Fairness Metric: *Statistical Parity Difference*

Original Fairness Outcome	Transformed Outcome	Change
-0.070486	0.000000	Positive

Original Fairness Outcome	Classifier – Original Outcome	Change
-0.070486	-0.1042	Negative

Transformed Fairness Outcome	Classifier – Transformed Outcome	Change
-0.070486	0.0721	Positive

Step 5

I am a team of one.

Code References

1.) **StandardDataset:** https://github.com/Trusted-AI/AIF360/blob/master/aif360/datasets/standard_dataset.py
2.) **Classifier code:** https://github.com/Trusted-AI/AIF360/blob/master/examples/demo_reweighing_preproc.ipynb