TP 2 - Members in the US Electoral College

General information

Population data is from 2016. We chose to use the eligible population as it is more representative of the 2016 Elections.

Linear Programming problem

Results and optimization

With our problem as stated before, we have a rather disturbing problem as we can see that some states have fairly similar populations but sometimes have double the members in the electoral college. This is particularly obvious when we took at the lower end of the population spectrum where there isn't a lot of population but we might see for example (insert problem with close population but 1 vs 2 members). This is due to a matrix conditioning problem when working on the LP problem as the orders of magnitude vary greatly between 10^{-6} $(u,\ v)$, 10^{0} (α_i) and 10^{6} (x_i).

Thus, our problem has been slightly modified to :

$$\begin{cases} min\ u - v & \\ v - \frac{\alpha_i}{x_i} \times 10^6 & \leq 0 \\ \frac{\alpha_i}{x_i} \times 10^6 - u & \leq 0 \\ \sum_i \alpha_i & = N \end{cases} \tag{1}$$

By doing this, we will do some kind of preconditioning which will make our results better. With this change, the number of members per state is given by (using the state ANSI abreviations):

State	Population	Members in Electoral College
AL		9
AK		1
AZ		12
AR		5
CA		49
CO		10
CT		6
DE		1
DC		1
FL		37
GA		17
HI		2
ID		2
IL		22
IN		12
IA		5
KS		5
KY		8
LA		8
ME		2
MD		10
MA		12
MI		18
MN		10
MS		5
MO		11
MT		2
NE		3
NV		4
NH		2
NJ		15
NM		3
NY		34
NC		18
ND		1
OH		22
OK		7
OR		7
PA		24
RI		2
SC		9
SD		1
TN		12
TX		44
UT		5
VT		1
VA		15
WA		13
WV		3
WI		10
WY		1

US Maps

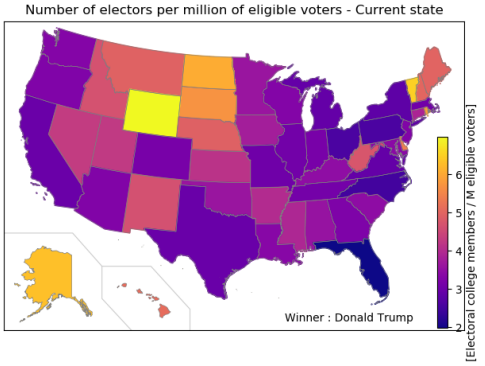

Figure 1: Current distribution : $\frac{\alpha_{real,eligible_i}}{x_i}$

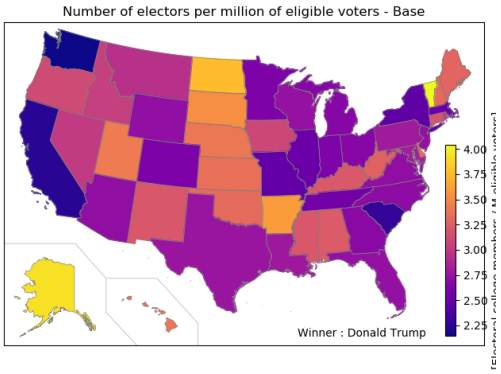

Figure 2: Distribution without conditioning - Eligible voters only

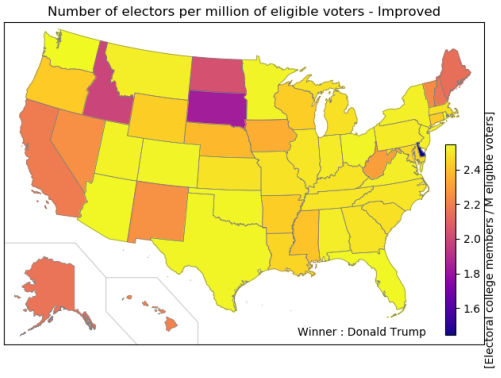

Figure 3: Distribution with conditioning - Eligible voters only

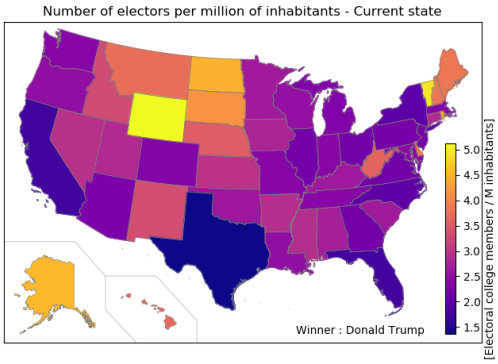

Figure 4: Current distribution : $\frac{\alpha_{real,total_i}}{x_i}$

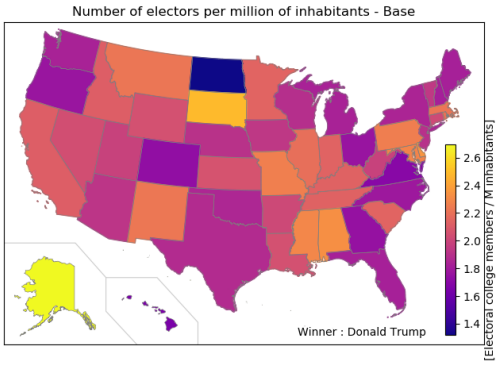

Figure 5: Distribution without conditioning - Whole population

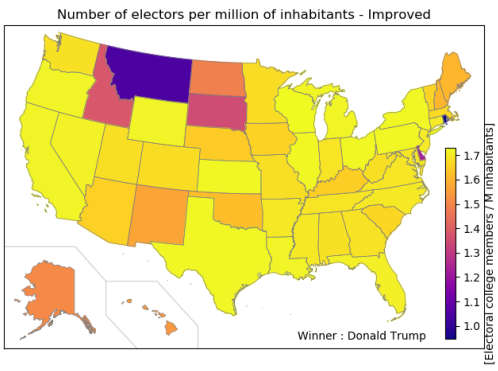

Figure 6: Distribution with conditioning - Whole population