

Ch13Teetor

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```
#-----Beyond Basic Numerics and Statistics-----#

#importing actual clickthrough data set to perform r commands and operations on

actualdata<-read.csv("C:/Users/AliDesktop/Desktop/Bit Briefcase/Big Data/Kaggle/CTR/train.csv",
                     nrow=1000)

#Checking variables of the clickthrough data set

names(actualdata)

## [1] "id"           "click"        "hour"
## [4] "C1"           "banner_pos"   "site_id"
## [7] "site_domain"  "site_category" "app_id"
## [10] "app_domain"   "app_category" "device_id"
## [13] "device_ip"    "device_model" "device_type"
## [16] "device_conn_type" "C14"         "C15"
## [19] "C16"          "C17"         "C18"
## [22] "C19"          "C20"         "C21"

#Minimizing or Maximizing a Single-Parameter Function
f <- function(x) 3*x^4 - 2*x^3 + 3*x^2 - 4*x + 5
optimize(f, lower=-20, upper=20) #minimise

## $minimum
## [1] 0.5972778
##
## $objective
## [1] 3.636756

#Performing Principal Component Analysis-using prcomp function
r <- prcomp(~actualdata$C14+actualdata$C17+actualdata$C18+actualdata$C19)
summary(r) #summary shows the proportion of variation captured by each component

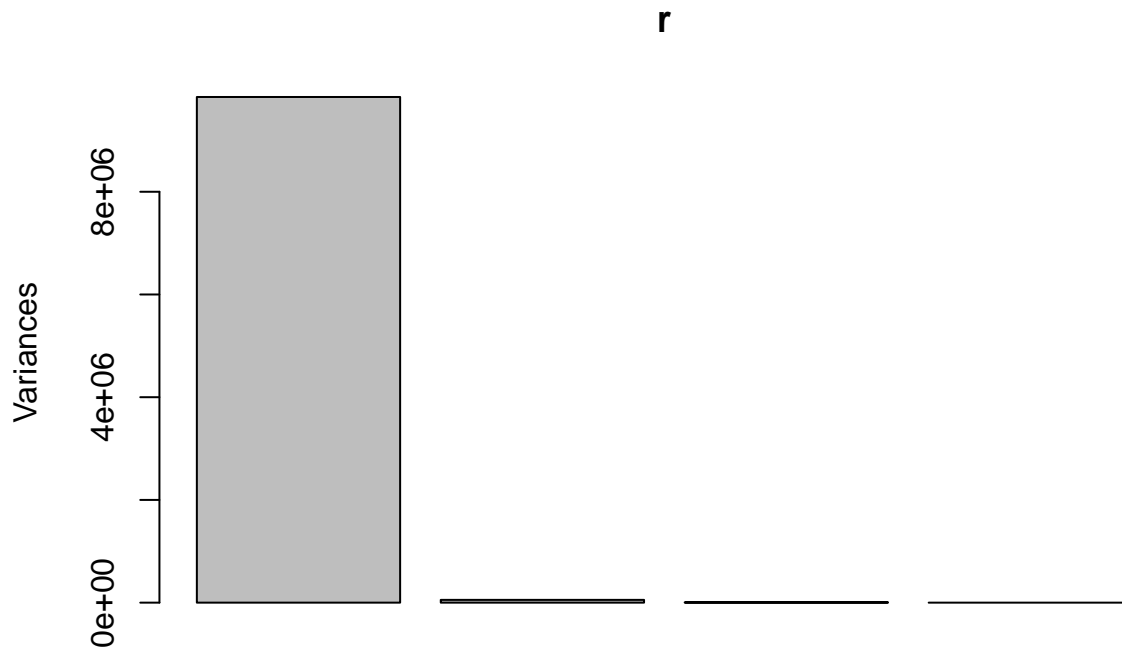
## Importance of components:
##
## Standard deviation      PC1      PC2      PC3      PC4
## Proportion of Variance  0.9939  0.00546  0.00068  0.000
## Cumulative Proportion  0.9939  0.99932  1.00000  1.000

#above summary shows that first component PC1 captures ~99.5% of the variance and other
# components capturing remaining

#The PCA recasts data into a vector space where the 1st dimension captures the most variance
#and the second dimension captures the second most, and so forth.
print(r)
```

```
## Standard deviations:
## [1] 3137.741496 232.612190 82.265173 1.157193
##
## Rotation:
##          PC1          PC2          PC3          PC4
## actualdata$C14 9.929803e-01 0.006271059 0.118113084 -0.0002597791
## actualdata$C17 1.182074e-01 -0.087520751 -0.989121214 0.0025186994
## actualdata$C18 4.627909e-05 0.001345340 -0.002659899 -0.9999955564
## actualdata$C19 4.134454e-03 0.996142049 -0.087643873 0.0015734716
```

*#in order to view a bar chart of the variances of the principal components,
use the below command*
`plot(r)`



#in order to rotate our actualdata to the principal components, use the below command-
`predict(r)`

```
##          PC1          PC2          PC3          PC4
## 1 -2025.59605 -80.39039 13.895863 0.55014573
## 2 -2027.58201 -80.40293 13.659637 0.55066529
## 3 -2027.58201 -80.40293 13.659637 0.55066529
## 4 -2025.59605 -80.39039 13.895863 0.55014573
## 5 1290.22331 -98.19903 -32.090643 0.80196076
## 6 -797.55799 306.20376 -52.496282 1.30367842
## 7 2669.96157 -100.68295 -40.873256 0.88583331
```

## 8	2942.91290	-102.57408	-49.544673	-2.08102705
## 9	-2024.60307	-80.38412	14.013976	0.54988595
## 10	4007.44361	20.88308	-56.590347	-1.84692790
## 11	30.88167	-85.65913	5.350226	-1.33904846
## 12	-2030.56096	-80.42174	13.305298	0.55144463
## 13	2881.97075	-88.14652	157.244630	0.38553480
## 14	2073.25935	550.38810	-62.624469	1.79199025
## 15	3294.20405	409.91659	-49.867187	1.62557873
## 16	-2032.54692	-80.43428	13.069071	0.55196419
## 17	204.86570	-90.65079	-43.174253	-1.20864131
## 18	-2023.61009	-80.37785	14.132089	0.54962617
## 19	-11245.42011	-33.03439	71.519994	-1.96611500
## 20	3548.29217	19.47147	-48.655709	-1.89118164
## 21	2660.03177	-100.74566	-42.054387	0.88843110
## 22	-2025.59605	-80.39039	13.895863	0.55014573
## 23	2673.93350	-100.65786	-40.400804	0.88479420
## 24	-2030.56096	-80.42174	13.305298	0.55144463
## 25	-2025.59605	-80.39039	13.895863	0.55014573
## 26	3982.71172	-110.49561	-44.888706	-2.05594755
## 27	3294.20405	409.91659	-49.867187	1.62557873
## 28	3928.63731	151.29274	-61.370932	-1.66241301
## 29	2673.93350	-100.65786	-40.400804	0.88479420
## 30	-2025.59605	-80.39039	13.895863	0.55014573
## 31	-2023.61009	-80.37785	14.132089	0.54962617
## 32	-882.62901	-87.29083	-10.667500	-2.34091901
## 33	-2023.61009	-80.37785	14.132089	0.54962617
## 34	-2032.54692	-80.43428	13.069071	0.55196419
## 35	2669.96157	-100.68295	-40.873256	0.88583331
## 36	1284.96936	157.04231	-52.276769	-1.80121460
## 37	2881.97075	-88.14652	157.244630	0.38553480
## 38	1290.22331	-98.19903	-32.090643	0.80196076
## 39	1290.22331	-98.19903	-32.090643	0.80196076
## 40	-2025.59605	-80.39039	13.895863	0.55014573
## 41	-2027.58201	-80.40293	13.659637	0.55066529
## 42	2176.76552	547.15803	-94.452607	1.87709489
## 43	-2023.61009	-80.37785	14.132089	0.54962617
## 44	3982.71172	-110.49561	-44.888706	-2.05594755
## 45	3973.74633	29.06810	-10.792028	-1.95929517
## 46	-1517.35387	47.42585	-15.539795	-2.17609326
## 47	-2030.56096	-80.42174	13.305298	0.55144463
## 48	-678.86265	-86.61075	-38.945215	-1.25535325
## 49	-797.55799	306.20376	-52.496282	1.30367842
## 50	2660.03177	-100.74566	-42.054387	0.88843110
## 51	2673.93350	-100.65786	-40.400804	0.88479420
## 52	-2026.58903	-80.39666	13.777750	0.55040551
## 53	1290.22331	-98.19903	-32.090643	0.80196076
## 54	-2030.56096	-80.42174	13.305298	0.55144463
## 55	-2030.56096	-80.42174	13.305298	0.55144463
## 56	-1106.29302	-83.04182	-18.563990	-2.32454967
## 57	2944.89886	-102.56153	-49.308447	-2.08154661
## 58	-2027.58201	-80.40293	13.659637	0.55066529
## 59	1290.22331	-98.19903	-32.090643	0.80196076
## 60	1290.22331	-98.19903	-32.090643	0.80196076
## 61	2881.97075	-88.14652	157.244630	0.38553480

## 62	-2032.54692	-80.43428	13.069071	0.55196419
## 63	-510.64680	-81.39849	28.210612	-2.41918903
## 64	-2026.58903	-80.39666	13.777750	0.55040551
## 65	2669.96157	-100.68295	-40.873256	0.88583331
## 66	-2023.61009	-80.37785	14.132089	0.54962617
## 67	30.88167	-85.65913	5.350226	-1.33904846
## 68	3928.63731	151.29274	-61.370932	-1.66241301
## 69	-2032.54692	-80.43428	13.069071	0.55196419
## 70	-2024.60307	-80.38412	14.013976	0.54988595
## 71	204.86570	-90.65079	-43.174253	-1.20864131
## 72	2660.03177	-100.74566	-42.054387	0.88843110
## 73	-2026.58903	-80.39666	13.777750	0.55040551
## 74	-2024.60307	-80.38412	14.013976	0.54988595
## 75	-2029.56798	-80.41547	13.423411	0.55118485
## 76	-59.10135	-87.99275	-25.416715	-1.26451501
## 77	1290.22331	-98.19903	-32.090643	0.80196076
## 78	2669.96157	-100.68295	-40.873256	0.88583331
## 79	1290.22331	-98.19903	-32.090643	0.80196076
## 80	-13120.78098	-31.81447	-3.079646	-1.85283575
## 81	-2028.57499	-80.40920	13.541524	0.55092507
## 82	4009.31132	20.98180	-55.362340	-0.84997060
## 83	-13120.78098	-31.81447	-3.079646	-1.85283575
## 84	-2029.56798	-80.41547	13.423411	0.55118485
## 85	-2032.54692	-80.43428	13.069071	0.55196419
## 86	-2032.54692	-80.43428	13.069071	0.55196419
## 87	2943.90588	-102.56780	-49.426560	-2.08128683
## 88	4000.49275	20.83919	-57.417139	-1.84510944
## 89	-2027.58201	-80.40293	13.659637	0.55066529
## 90	-2029.56798	-80.41547	13.423411	0.55118485
## 91	-2028.57499	-80.40920	13.541524	0.55092507
## 92	-2026.58903	-80.39666	13.777750	0.55040551
## 93	-13120.78098	-31.81447	-3.079646	-1.85283575
## 94	3928.63731	151.29274	-61.370932	-1.66241301
## 95	-678.86265	-86.61075	-38.945215	-1.25535325
## 96	-2030.56096	-80.42174	13.305298	0.55144463
## 97	-2030.56096	-80.42174	13.305298	0.55144463
## 98	-2023.61009	-80.37785	14.132089	0.54962617
## 99	-2025.59605	-80.39039	13.895863	0.55014573
## 100	-2030.56096	-80.42174	13.305298	0.55144463
## 101	2074.25233	550.39438	-62.506356	1.79173047
## 102	2669.96157	-100.68295	-40.873256	0.88583331
## 103	-2030.56096	-80.42174	13.305298	0.55144463
## 104	-510.64680	-81.39849	28.210612	-2.41918903
## 105	-2027.58201	-80.40293	13.659637	0.55066529
## 106	2881.97075	-88.14652	157.244630	0.38553480
## 107	-2024.60307	-80.38412	14.013976	0.54988595
## 108	3982.71172	-110.49561	-44.888706	-2.05594755
## 109	1243.23544	292.69185	-64.211480	-1.58890523
## 110	-2029.56798	-80.41547	13.423411	0.55118485
## 111	2881.97075	-88.14652	157.244630	0.38553480
## 112	1969.48929	164.93198	-67.211680	-0.71919119
## 113	2660.03177	-100.74566	-42.054387	0.88843110
## 114	2048.75475	287.98135	-79.749693	-1.51663335
## 115	-2026.58903	-80.39666	13.777750	0.55040551

## 116	1290.22331	-98.19903	-32.090643	0.80196076
## 117	-2024.60307	-80.38412	14.013976	0.54988595
## 118	-861.16885	-83.61218	-13.483307	-2.32748699
## 119	2660.03177	-100.74566	-42.054387	0.88843110
## 120	2673.93350	-100.65786	-40.400804	0.88479420
## 121	-2029.56798	-80.41547	13.423411	0.55118485
## 122	2073.25935	550.38810	-62.624469	1.79199025
## 123	-2027.58201	-80.40293	13.659637	0.55066529
## 124	-2024.60307	-80.38412	14.013976	0.54988595
## 125	3615.28044	26.80425	-53.430851	-1.86551490
## 126	-797.55799	306.20376	-52.496282	1.30367842
## 127	3928.63731	151.29274	-61.370932	-1.66241301
## 128	3982.71172	-110.49561	-44.888706	-2.05594755
## 129	-2029.56798	-80.41547	13.423411	0.55118485
## 130	2881.97075	-88.14652	157.244630	0.38553480
## 131	-2026.58903	-80.39666	13.777750	0.55040551
## 132	-51.90585	-86.13295	-26.740794	-0.25815356
## 133	-2026.58903	-80.39666	13.777750	0.55040551
## 134	2673.93350	-100.65786	-40.400804	0.88479420
## 135	2881.97075	-88.14652	157.244630	0.38553480
## 136	1290.22331	-98.19903	-32.090643	0.80196076
## 137	2660.03177	-100.74566	-42.054387	0.88843110
## 138	-8345.37875	342.91143	54.234556	-2.28015277
## 139	-2024.60307	-80.38412	14.013976	0.54988595
## 140	1290.22331	-98.19903	-32.090643	0.80196076
## 141	-460.78493	-79.75959	49.189310	-2.47047803
## 142	-2029.56798	-80.41547	13.423411	0.55118485
## 143	3615.28044	26.80425	-53.430851	-1.86551490
## 144	3982.71172	-110.49561	-44.888706	-2.05594755
## 145	1290.22331	-98.19903	-32.090643	0.80196076
## 146	2881.97075	-88.14652	157.244630	0.38553480
## 147	-2032.54692	-80.43428	13.069071	0.55196419
## 148	2666.98263	-100.70176	-41.227595	0.88661265
## 149	2881.97075	-88.14652	157.244630	0.38553480
## 150	-2027.58201	-80.40293	13.659637	0.55066529
## 151	-2023.61009	-80.37785	14.132089	0.54962617
## 152	165.34514	-82.31224	-41.560626	-2.20354860
## 153	-2023.61009	-80.37785	14.132089	0.54962617
## 154	-2029.56798	-80.41547	13.423411	0.55118485
## 155	-2023.61009	-80.37785	14.132089	0.54962617
## 156	-2025.59605	-80.39039	13.895863	0.55014573
## 157	1290.22331	-98.19903	-32.090643	0.80196076
## 158	1313.19669	-94.15505	-30.719059	-1.19519269
## 159	1290.22331	-98.19903	-32.090643	0.80196076
## 160	2669.96157	-100.68295	-40.873256	0.88583331
## 161	-13120.78098	-31.81447	-3.079646	-1.85283575
## 162	-2029.56798	-80.41547	13.423411	0.55118485
## 163	2881.97075	-88.14652	157.244630	0.38553480
## 164	2660.03177	-100.74566	-42.054387	0.88843110
## 165	1290.22331	-98.19903	-32.090643	0.80196076
## 166	-13120.78098	-31.81447	-3.079646	-1.85283575
## 167	-11187.25275	-37.09284	73.775522	-1.97488258
## 168	2477.35621	27.45713	-53.997838	1.08422258
## 169	-2030.56096	-80.42174	13.305298	0.55144463

## 170	-2027.58201	-80.40293	13.659637	0.55066529
## 171	-94.70509	931.89339	-118.899443	0.35459239
## 172	3929.74850	151.21149	-62.241940	-1.66015409
## 173	43.31918	932.76506	-102.481724	0.31848309
## 174	3972.75335	29.06183	-10.910141	-1.95903539
## 175	-2030.56096	-80.42174	13.305298	0.55144463
## 176	2660.03177	-100.74566	-42.054387	0.88843110
## 177	-11240.33700	-33.09056	71.121438	-1.96489520
## 178	-2025.59605	-80.39039	13.895863	0.55014573
## 179	-2026.58903	-80.39666	13.777750	0.55040551
## 180	3982.71172	-110.49561	-44.888706	-2.05594755
## 181	-2023.61009	-80.37785	14.132089	0.54962617
## 182	-2029.56798	-80.41547	13.423411	0.55118485
## 183	-11187.25275	-37.09284	73.775522	-1.97488258
## 184	2198.37847	70.89216	426.439365	-3.14818679
## 185	-2023.61009	-80.37785	14.132089	0.54962617
## 186	2673.93350	-100.65786	-40.400804	0.88479420
## 187	2669.96157	-100.68295	-40.873256	0.88583331
## 188	2881.97075	-88.14652	157.244630	0.38553480
## 189	-94.70509	931.89339	-118.899443	0.35459239
## 190	-2026.58903	-80.39666	13.777750	0.55040551
## 191	-2025.59605	-80.39039	13.895863	0.55014573
## 192	1313.19669	-94.15505	-30.719059	-1.19519269
## 193	1290.22331	-98.19903	-32.090643	0.80196076
## 194	1290.22331	-98.19903	-32.090643	0.80196076
## 195	-2027.58201	-80.40293	13.659637	0.55066529
## 196	1290.22331	-98.19903	-32.090643	0.80196076
## 197	2660.03177	-100.74566	-42.054387	0.88843110
## 198	-2025.59605	-80.39039	13.895863	0.55014573
## 199	2881.97075	-88.14652	157.244630	0.38553480
## 200	2881.97075	-88.14652	157.244630	0.38553480
## 201	2881.97075	-88.14652	157.244630	0.38553480
## 202	-94.70509	931.89339	-118.899443	0.35459239
## 203	2477.35621	27.45713	-53.997838	1.08422258
## 204	-2026.58903	-80.39666	13.777750	0.55040551
## 205	-2027.58201	-80.40293	13.659637	0.55066529
## 206	2669.96157	-100.68295	-40.873256	0.88583331
## 207	2660.03177	-100.74566	-42.054387	0.88843110
## 208	3928.63731	151.29274	-61.370932	-1.66241301
## 209	2669.96157	-100.68295	-40.873256	0.88583331
## 210	-473.67049	-88.75596	-53.664759	-2.20959491
## 211	-2032.54692	-80.43428	13.069071	0.55196419
## 212	-2023.61009	-80.37785	14.132089	0.54962617
## 213	3982.71172	-110.49561	-44.888706	-2.05594755
## 214	-2030.56096	-80.42174	13.305298	0.55144463
## 215	1290.22331	-98.19903	-32.090643	0.80196076
## 216	-59.10135	-87.99275	-25.416715	-1.26451501
## 217	2881.97075	-88.14652	157.244630	0.38553480
## 218	-2023.61009	-80.37785	14.132089	0.54962617
## 219	-2026.58903	-80.39666	13.777750	0.55040551
## 220	2673.93350	-100.65786	-40.400804	0.88479420
## 221	-636.67509	-77.22657	-21.593475	-2.28693440
## 222	2669.96157	-100.68295	-40.873256	0.88583331
## 223	2653.83757	-100.60555	-40.790143	-1.11503873

## 224	-2030.56096	-80.42174	13.305298	0.55144463
## 225	-2024.60307	-80.38412	14.013976	0.54988595
## 226	3982.71172	-110.49561	-44.888706	-2.05594755
## 227	-2023.61009	-80.37785	14.132089	0.54962617
## 228	-2028.57499	-80.40920	13.541524	0.55092507
## 229	-2024.60307	-80.38412	14.013976	0.54988595
## 230	-11245.42011	-33.03439	71.519994	-1.96611500
## 231	2073.25935	550.38810	-62.624469	1.79199025
## 232	2669.96157	-100.68295	-40.873256	0.88583331
## 233	1290.22331	-98.19903	-32.090643	0.80196076
## 234	2669.96157	-100.68295	-40.873256	0.88583331
## 235	-2032.54692	-80.43428	13.069071	0.55196419
## 236	3625.53165	18.63122	-54.507954	1.12684230
## 237	2673.93350	-100.65786	-40.400804	0.88479420
## 238	-2030.56096	-80.42174	13.305298	0.55144463
## 239	2669.96157	-100.68295	-40.873256	0.88583331
## 240	-1517.35387	47.42585	-15.539795	-2.17609326
## 241	-2025.59605	-80.39039	13.895863	0.55014573
## 242	3928.63731	151.29274	-61.370932	-1.66241301
## 243	-2024.60307	-80.38412	14.013976	0.54988595
## 244	-2030.56096	-80.42174	13.305298	0.55144463
## 245	2881.97075	-88.14652	157.244630	0.38553480
## 246	2623.46186	851.85873	468.799845	-2.19051937
## 247	2073.25935	550.38810	-62.624469	1.79199025
## 248	-2032.54692	-80.43428	13.069071	0.55196419
## 249	3928.63731	151.29274	-61.370932	-1.66241301
## 250	-2028.57499	-80.40920	13.541524	0.55092507
## 251	2673.93350	-100.65786	-40.400804	0.88479420
## 252	-2027.58201	-80.40293	13.659637	0.55066529
## 253	2669.96157	-100.68295	-40.873256	0.88583331
## 254	2073.25935	550.38810	-62.624469	1.79199025
## 255	2881.97075	-88.14652	157.244630	0.38553480
## 256	-59.10135	-87.99275	-25.416715	-1.26451501
## 257	-2030.56096	-80.42174	13.305298	0.55144463
## 258	1290.22331	-98.19903	-32.090643	0.80196076
## 259	2660.03177	-100.74566	-42.054387	0.88843110
## 260	3928.63731	151.29274	-61.370932	-1.66241301
## 261	2881.97075	-88.14652	157.244630	0.38553480
## 262	2669.96157	-100.68295	-40.873256	0.88583331
## 263	-2026.58903	-80.39666	13.777750	0.55040551
## 264	2944.89886	-102.56153	-49.308447	-2.08154661
## 265	3928.63731	151.29274	-61.370932	-1.66241301
## 266	2881.97075	-88.14652	157.244630	0.38553480
## 267	2048.75475	287.98135	-79.749693	-1.51663335
## 268	-2029.56798	-80.41547	13.423411	0.55118485
## 269	-59.10135	-87.99275	-25.416715	-1.26451501
## 270	-727.47136	-86.21159	-36.701673	-1.26303344
## 271	-2023.61009	-80.37785	14.132089	0.54962617
## 272	-2024.60307	-80.38412	14.013976	0.54988595
## 273	-2023.61009	-80.37785	14.132089	0.54962617
## 274	2653.83757	-100.60555	-40.790143	-1.11503873
## 275	3982.71172	-110.49561	-44.888706	-2.05594755
## 276	-2028.57499	-80.40920	13.541524	0.55092507
## 277	-550.75205	35.86443	-55.705012	-2.04007781

## 278	-2028.57499	-80.40920	13.541524	0.55092507
## 279	-13120.78098	-31.81447	-3.079646	-1.85283575
## 280	2881.97075	-88.14652	157.244630	0.38553480
## 281	-2028.57499	-80.40920	13.541524	0.55092507
## 282	4006.45063	20.87681	-56.708460	-1.84666812
## 283	-1517.35387	47.42585	-15.539795	-2.17609326
## 284	2459.86811	23.80759	-50.717559	-1.93023522
## 285	-2028.57499	-80.40920	13.541524	0.55092507
## 286	1290.22331	-98.19903	-32.090643	0.80196076
## 287	-2029.56798	-80.41547	13.423411	0.55118485
## 288	-2024.60307	-80.38412	14.013976	0.54988595
## 289	-1106.29302	-83.04182	-18.563990	-2.32454967
## 290	2669.96157	-100.68295	-40.873256	0.88583331
## 291	2944.89886	-102.56153	-49.308447	-2.08154661
## 292	828.72350	1786.25687	826.763970	-1.96864291
## 293	1290.22331	-98.19903	-32.090643	0.80196076
## 294	3982.71172	-110.49561	-44.888706	-2.05594755
## 295	-8318.51419	1227.36724	-23.843966	-0.88132880
## 296	-2032.54692	-80.43428	13.069071	0.55196419
## 297	-2026.58903	-80.39666	13.777750	0.55040551
## 298	2623.46186	851.85873	468.799845	-2.19051937
## 299	-727.47136	-86.21159	-36.701673	-1.26303344
## 300	-2730.20897	48.17303	4.248880	0.71615910
## 301	2048.75475	287.98135	-79.749693	-1.51663335
## 302	2881.97075	-88.14652	157.244630	0.38553480
## 303	1290.22331	-98.19903	-32.090643	0.80196076
## 304	3290.23213	409.89151	-50.339639	1.62661785
## 305	-2032.54692	-80.43428	13.069071	0.55196419
## 306	2942.91290	-102.57408	-49.544673	-2.08102705
## 307	-1655.25046	55.93484	-16.593839	-1.16821938
## 308	-2027.58201	-80.40293	13.659637	0.55066529
## 309	-8345.37875	342.91143	54.234556	-2.28015277
## 310	-2030.56096	-80.42174	13.305298	0.55144463
## 311	-2032.54692	-80.43428	13.069071	0.55196419
## 312	-2032.54692	-80.43428	13.069071	0.55196419
## 313	-2024.60307	-80.38412	14.013976	0.54988595
## 314	2653.83757	-100.60555	-40.790143	-1.11503873
## 315	1284.96936	157.04231	-52.276769	-1.80121460
## 316	3624.53867	18.62495	-54.626067	1.12710208
## 317	3928.63731	151.29274	-61.370932	-1.66241301
## 318	2673.93350	-100.65786	-40.400804	0.88479420
## 319	-2032.54692	-80.43428	13.069071	0.55196419
## 320	-13120.78098	-31.81447	-3.079646	-1.85283575
## 321	-1517.35387	47.42585	-15.539795	-2.17609326
## 322	-2027.58201	-80.40293	13.659637	0.55066529
## 323	1313.19669	-94.15505	-30.719059	-1.19519269
## 324	-2029.56798	-80.41547	13.423411	0.55118485
## 325	-2028.57499	-80.40920	13.541524	0.55092507
## 326	-2027.58201	-80.40293	13.659637	0.55066529
## 327	-2028.57499	-80.40920	13.541524	0.55092507
## 328	-2026.58903	-80.39666	13.777750	0.55040551
## 329	-2024.60307	-80.38412	14.013976	0.54988595
## 330	-2027.58201	-80.40293	13.659637	0.55066529
## 331	2881.97075	-88.14652	157.244630	0.38553480

## 332	-2030.56096	-80.42174	13.305298	0.55144463
## 333	-1517.35387	47.42585	-15.539795	-2.17609326
## 334	2881.97075	-88.14652	157.244630	0.38553480
## 335	2673.93350	-100.65786	-40.400804	0.88479420
## 336	-2023.61009	-80.37785	14.132089	0.54962617
## 337	-678.86265	-86.61075	-38.945215	-1.25535325
## 338	3007.11038	579.61378	382.040459	0.69175765
## 339	-2024.60307	-80.38412	14.013976	0.54988595
## 340	-2032.54692	-80.43428	13.069071	0.55196419
## 341	-510.64680	-81.39849	28.210612	-2.41918903
## 342	2198.37847	70.89216	426.439365	-3.14818679
## 343	3294.20405	409.91659	-49.867187	1.62557873
## 344	2944.89886	-102.56153	-49.308447	-2.08154661
## 345	-2028.57499	-80.40920	13.541524	0.55092507
## 346	-2024.60307	-80.38412	14.013976	0.54988595
## 347	3982.71172	-110.49561	-44.888706	-2.05594755
## 348	-59.10135	-87.99275	-25.416715	-1.26451501
## 349	-2025.59605	-80.39039	13.895863	0.55014573
## 350	-2028.57499	-80.40920	13.541524	0.55092507
## 351	-2023.61009	-80.37785	14.132089	0.54962617
## 352	-94.70509	931.89339	-118.899443	0.35459239
## 353	-2026.58903	-80.39666	13.777750	0.55040551
## 354	2660.03177	-100.74566	-42.054387	0.88843110
## 355	-678.86265	-86.61075	-38.945215	-1.25535325
## 356	2666.98263	-100.70176	-41.227595	0.88661265
## 357	-2026.58903	-80.39666	13.777750	0.55040551
## 358	-2032.54692	-80.43428	13.069071	0.55196419
## 359	1290.22331	-98.19903	-32.090643	0.80196076
## 360	-17428.02458	1243.46447	-316.244704	-0.50349420
## 361	-2023.61009	-80.37785	14.132089	0.54962617
## 362	1312.20371	-94.16132	-30.837172	-1.19493291
## 363	3928.63731	151.29274	-61.370932	-1.66241301
## 364	2817.57725	22.18290	-52.308747	-1.91163404
## 365	-2024.60307	-80.38412	14.013976	0.54988595
## 366	-2030.56096	-80.42174	13.305298	0.55144463
## 367	1290.22331	-98.19903	-32.090643	0.80196076
## 368	-2026.58903	-80.39666	13.777750	0.55040551
## 369	3973.74633	29.06810	-10.792028	-1.95929517
## 370	2881.97075	-88.14652	157.244630	0.38553480
## 371	-2027.58201	-80.40293	13.659637	0.55066529
## 372	-2024.60307	-80.38412	14.013976	0.54988595
## 373	-2023.61009	-80.37785	14.132089	0.54962617
## 374	3290.23213	409.89151	-50.339639	1.62661785
## 375	-2030.56096	-80.42174	13.305298	0.55144463
## 376	-2024.60307	-80.38412	14.013976	0.54988595
## 377	2673.93350	-100.65786	-40.400804	0.88479420
## 378	2881.97075	-88.14652	157.244630	0.38553480
## 379	2881.97075	-88.14652	157.244630	0.38553480
## 380	2660.03177	-100.74566	-42.054387	0.88843110
## 381	-797.55799	306.20376	-52.496282	1.30367842
## 382	-2023.61009	-80.37785	14.132089	0.54962617
## 383	2048.75475	287.98135	-79.749693	-1.51663335
## 384	3007.11038	579.61378	382.040459	0.69175765
## 385	2673.93350	-100.65786	-40.400804	0.88479420

## 386	-2029.56798	-80.41547	13.423411	0.55118485
## 387	2074.25233	550.39438	-62.506356	1.79173047
## 388	-13120.78098	-31.81447	-3.079646	-1.85283575
## 389	3972.75335	29.06183	-10.910141	-1.95903539
## 390	-2027.58201	-80.40293	13.659637	0.55066529
## 391	1290.22331	-98.19903	-32.090643	0.80196076
## 392	3928.63731	151.29274	-61.370932	-1.66241301
## 393	2198.37847	70.89216	426.439365	-3.14818679
## 394	3294.20405	409.91659	-49.867187	1.62557873
## 395	-2030.56096	-80.42174	13.305298	0.55144463
## 396	-2030.56096	-80.42174	13.305298	0.55144463
## 397	-2023.61009	-80.37785	14.132089	0.54962617
## 398	1969.48929	164.93198	-67.211680	-0.71919119
## 399	2666.98263	-100.70176	-41.227595	0.88661265
## 400	-2030.56096	-80.42174	13.305298	0.55144463
## 401	-2029.56798	-80.41547	13.423411	0.55118485
## 402	2881.97075	-88.14652	157.244630	0.38553480
## 403	-13120.78098	-31.81447	-3.079646	-1.85283575
## 404	-2027.58201	-80.40293	13.659637	0.55066529
## 405	-2030.56096	-80.42174	13.305298	0.55144463
## 406	2669.96157	-100.68295	-40.873256	0.88583331
## 407	2944.89886	-102.56153	-49.308447	-2.08154661
## 408	-60.09433	-87.99902	-25.534828	-1.26425523
## 409	204.86570	-90.65079	-43.174253	-1.20864131
## 410	-2028.57499	-80.40920	13.541524	0.55092507
## 411	2669.96157	-100.68295	-40.873256	0.88583331
## 412	-2028.57499	-80.40920	13.541524	0.55092507
## 413	3982.71172	-110.49561	-44.888706	-2.05594755
## 414	2660.03177	-100.74566	-42.054387	0.88843110
## 415	-17431.99650	1243.43938	-316.717157	-0.50245509
## 416	-2024.60307	-80.38412	14.013976	0.54988595
## 417	1290.22331	-98.19903	-32.090643	0.80196076
## 418	1970.48227	164.93825	-67.093567	-0.71945097
## 419	-2027.58201	-80.40293	13.659637	0.55066529
## 420	-2024.60307	-80.38412	14.013976	0.54988595
## 421	-2030.56096	-80.42174	13.305298	0.55144463
## 422	2673.93350	-100.65786	-40.400804	0.88479420
## 423	-17352.36898	1243.05959	-317.277435	-0.49779065
## 424	-678.86265	-86.61075	-38.945215	-1.25535325
## 425	-2027.58201	-80.40293	13.659637	0.55066529
## 426	2817.57725	22.18290	-52.308747	-1.91163404
## 427	-59.10135	-87.99275	-25.416715	-1.26451501
## 428	3928.63731	151.29274	-61.370932	-1.66241301
## 429	2073.25935	550.38810	-62.624469	1.79199025
## 430	3294.20405	409.91659	-49.867187	1.62557873
## 431	-2023.61009	-80.37785	14.132089	0.54962617
## 432	-2032.54692	-80.43428	13.069071	0.55196419
## 433	2074.25233	550.39438	-62.506356	1.79173047
## 434	2881.97075	-88.14652	157.244630	0.38553480
## 435	-2028.57499	-80.40920	13.541524	0.55092507
## 436	-2026.58903	-80.39666	13.777750	0.55040551
## 437	-2023.61009	-80.37785	14.132089	0.54962617
## 438	3928.63731	151.29274	-61.370932	-1.66241301
## 439	2881.97075	-88.14652	157.244630	0.38553480

## 440	2881.97075	-88.14652	157.244630	0.38553480
## 441	2881.97075	-88.14652	157.244630	0.38553480
## 442	-2029.56798	-80.41547	13.423411	0.55118485
## 443	1290.22331	-98.19903	-32.090643	0.80196076
## 444	1290.22331	-98.19903	-32.090643	0.80196076
## 445	2881.97075	-88.14652	157.244630	0.38553480
## 446	-60.09433	-87.99902	-25.534828	-1.26425523
## 447	43.31918	932.76506	-102.481724	0.31848309
## 448	2881.97075	-88.14652	157.244630	0.38553480
## 449	1290.22331	-98.19903	-32.090643	0.80196076
## 450	2673.93350	-100.65786	-40.400804	0.88479420
## 451	2673.93350	-100.65786	-40.400804	0.88479420
## 452	2652.84459	-100.61182	-40.908256	-1.11477895
## 453	1290.22331	-98.19903	-32.090643	0.80196076
## 454	2660.03177	-100.74566	-42.054387	0.88843110
## 455	-60.09433	-87.99902	-25.534828	-1.26425523
## 456	-11244.42712	-33.02812	71.638107	-1.96637478
## 457	2673.93350	-100.65786	-40.400804	0.88479420
## 458	1313.19669	-94.15505	-30.719059	-1.19519269
## 459	-2023.61009	-80.37785	14.132089	0.54962617
## 460	3928.63731	151.29274	-61.370932	-1.66241301
## 461	2561.23781	544.99622	-100.885826	1.90909141
## 462	43.31918	932.76506	-102.481724	0.31848309
## 463	-2023.61009	-80.37785	14.132089	0.54962617
## 464	2881.97075	-88.14652	157.244630	0.38553480
## 465	-678.86265	-86.61075	-38.945215	-1.25535325
## 466	3982.71172	-110.49561	-44.888706	-2.05594755
## 467	2074.25233	550.39438	-62.506356	1.79173047
## 468	1290.22331	-98.19903	-32.090643	0.80196076
## 469	2660.03177	-100.74566	-42.054387	0.88843110
## 470	-2023.61009	-80.37785	14.132089	0.54962617
## 471	-2028.57499	-80.40920	13.541524	0.55092507
## 472	4007.44361	20.88308	-56.590347	-1.84692790
## 473	2881.97075	-88.14652	157.244630	0.38553480
## 474	-2028.57499	-80.40920	13.541524	0.55092507
## 475	-2026.58903	-80.39666	13.777750	0.55040551
## 476	-2025.59605	-80.39039	13.895863	0.55014573
## 477	-2028.57499	-80.40920	13.541524	0.55092507
## 478	-2023.61009	-80.37785	14.132089	0.54962617
## 479	2669.96157	-100.68295	-40.873256	0.88583331
## 480	-2027.58201	-80.40293	13.659637	0.55066529
## 481	-550.75205	35.86443	-55.705012	-2.04007781
## 482	-11244.42712	-33.02812	71.638107	-1.96637478
## 483	-2026.58903	-80.39666	13.777750	0.55040551
## 484	2881.97075	-88.14652	157.244630	0.38553480
## 485	2881.97075	-88.14652	157.244630	0.38553480
## 486	-2026.58903	-80.39666	13.777750	0.55040551
## 487	-2023.61009	-80.37785	14.132089	0.54962617
## 488	3928.63731	151.29274	-61.370932	-1.66241301
## 489	2881.97075	-88.14652	157.244630	0.38553480
## 490	-2030.56096	-80.42174	13.305298	0.55144463
## 491	-2029.56798	-80.41547	13.423411	0.55118485
## 492	2673.93350	-100.65786	-40.400804	0.88479420
## 493	-2030.56096	-80.42174	13.305298	0.55144463

## 494	3928.63731	151.29274	-61.370932	-1.66241301
## 495	2660.03177	-100.74566	-42.054387	0.88843110
## 496	-2032.54692	-80.43428	13.069071	0.55196419
## 497	-2028.57499	-80.40920	13.541524	0.55092507
## 498	2817.57725	22.18290	-52.308747	-1.91163404
## 499	-2024.60307	-80.38412	14.013976	0.54988595
## 500	-2024.60307	-80.38412	14.013976	0.54988595
## 501	2881.97075	-88.14652	157.244630	0.38553480
## 502	2942.91290	-102.57408	-49.544673	-2.08102705
## 503	1290.22331	-98.19903	-32.090643	0.80196076
## 504	-510.64680	-81.39849	28.210612	-2.41918903
## 505	-678.86265	-86.61075	-38.945215	-1.25535325
## 506	43.31918	932.76506	-102.481724	0.31848309
## 507	2942.91290	-102.57408	-49.544673	-2.08102705
## 508	-60.09433	-87.99902	-25.534828	-1.26425523
## 509	2660.03177	-100.74566	-42.054387	0.88843110
## 510	2881.97075	-88.14652	157.244630	0.38553480
## 511	3982.71172	-110.49561	-44.888706	-2.05594755
## 512	-550.75205	35.86443	-55.705012	-2.04007781
## 513	2673.93350	-100.65786	-40.400804	0.88479420
## 514	1290.22331	-98.19903	-32.090643	0.80196076
## 515	-2023.61009	-80.37785	14.132089	0.54962617
## 516	-2027.58201	-80.40293	13.659637	0.55066529
## 517	204.86570	-90.65079	-43.174253	-1.20864131
## 518	-2023.61009	-80.37785	14.132089	0.54962617
## 519	-2029.56798	-80.41547	13.423411	0.55118485
## 520	-2023.61009	-80.37785	14.132089	0.54962617
## 521	1290.22331	-98.19903	-32.090643	0.80196076
## 522	1290.22331	-98.19903	-32.090643	0.80196076
## 523	3928.63731	151.29274	-61.370932	-1.66241301
## 524	3502.41762	18.06951	-43.898978	0.09216559
## 525	-2023.61009	-80.37785	14.132089	0.54962617
## 526	-678.86265	-86.61075	-38.945215	-1.25535325
## 527	-1517.35387	47.42585	-15.539795	-2.17609326
## 528	-2023.61009	-80.37785	14.132089	0.54962617
## 529	2881.97075	-88.14652	157.244630	0.38553480
## 530	4010.02809	-102.70724	-46.357289	-2.04029902
## 531	-2024.60307	-80.38412	14.013976	0.54988595
## 532	1313.19669	-94.15505	-30.719059	-1.19519269
## 533	2669.96157	-100.68295	-40.873256	0.88583331
## 534	1290.22331	-98.19903	-32.090643	0.80196076
## 535	-2030.56096	-80.42174	13.305298	0.55144463
## 536	-2024.60307	-80.38412	14.013976	0.54988595
## 537	3928.63731	151.29274	-61.370932	-1.66241301
## 538	-2030.56096	-80.42174	13.305298	0.55144463
## 539	-2025.59605	-80.39039	13.895863	0.55014573
## 540	-2026.58903	-80.39666	13.777750	0.55040551
## 541	2673.93350	-100.65786	-40.400804	0.88479420
## 542	-2023.61009	-80.37785	14.132089	0.54962617
## 543	2660.03177	-100.74566	-42.054387	0.88843110
## 544	-2026.58903	-80.39666	13.777750	0.55040551
## 545	-60.09433	-87.99902	-25.534828	-1.26425523
## 546	-2028.57499	-80.40920	13.541524	0.55092507
## 547	-2028.57499	-80.40920	13.541524	0.55092507

## 548	-59.10135	-87.99275	-25.416715	-1.26451501
## 549	-2026.58903	-80.39666	13.777750	0.55040551
## 550	30.88167	-85.65913	5.350226	-1.33904846
## 551	-2029.56798	-80.41547	13.423411	0.55118485
## 552	-2024.60307	-80.38412	14.013976	0.54988595
## 553	2669.96157	-100.68295	-40.873256	0.88583331
## 554	-2026.58903	-80.39666	13.777750	0.55040551
## 555	-2032.54692	-80.43428	13.069071	0.55196419
## 556	-2032.54692	-80.43428	13.069071	0.55196419
## 557	-2027.58201	-80.40293	13.659637	0.55066529
## 558	-1106.29302	-83.04182	-18.563990	-2.32454967
## 559	-2023.61009	-80.37785	14.132089	0.54962617
## 560	1290.22331	-98.19903	-32.090643	0.80196076
## 561	2073.25935	550.38810	-62.624469	1.79199025
## 562	-2025.59605	-80.39039	13.895863	0.55014573
## 563	-2024.60307	-80.38412	14.013976	0.54988595
## 564	3929.74850	151.21149	-62.241940	-1.66015409
## 565	-2027.58201	-80.40293	13.659637	0.55066529
## 566	-797.55799	306.20376	-52.496282	1.30367842
## 567	3928.63731	151.29274	-61.370932	-1.66241301
## 568	2673.93350	-100.65786	-40.400804	0.88479420
## 569	-1517.35387	47.42585	-15.539795	-2.17609326
## 570	-2023.61009	-80.37785	14.132089	0.54962617
## 571	-2024.60307	-80.38412	14.013976	0.54988595
## 572	2673.93350	-100.65786	-40.400804	0.88479420
## 573	-2024.60307	-80.38412	14.013976	0.54988595
## 574	43.31918	932.76506	-102.481724	0.31848309
## 575	1290.22331	-98.19903	-32.090643	0.80196076
## 576	2944.89886	-102.56153	-49.308447	-2.08154661
## 577	-13120.78098	-31.81447	-3.079646	-1.85283575
## 578	2660.03177	-100.74566	-42.054387	0.88843110
## 579	604.34457	37.83377	-47.236591	0.99351677
## 580	-2029.56798	-80.41547	13.423411	0.55118485
## 581	-2030.56096	-80.42174	13.305298	0.55144463
## 582	-2024.60307	-80.38412	14.013976	0.54988595
## 583	-2027.58201	-80.40293	13.659637	0.55066529
## 584	-2027.58201	-80.40293	13.659637	0.55066529
## 585	2881.97075	-88.14652	157.244630	0.38553480
## 586	2669.96157	-100.68295	-40.873256	0.88583331
## 587	-2028.57499	-80.40920	13.541524	0.55092507
## 588	-2029.56798	-80.41547	13.423411	0.55118485
## 589	1969.48929	164.93198	-67.211680	-0.71919119
## 590	2171.66588	543.22962	-93.703476	1.86958120
## 591	2881.97075	-88.14652	157.244630	0.38553480
## 592	2660.03177	-100.74566	-42.054387	0.88843110
## 593	-2024.60307	-80.38412	14.013976	0.54988595
## 594	-2028.57499	-80.40920	13.541524	0.55092507
## 595	-2024.60307	-80.38412	14.013976	0.54988595
## 596	43.31918	932.76506	-102.481724	0.31848309
## 597	-94.70509	931.89339	-118.899443	0.35459239
## 598	-2024.60307	-80.38412	14.013976	0.54988595
## 599	3928.63731	151.29274	-61.370932	-1.66241301
## 600	2398.34154	-103.02595	-34.713814	-1.14628168
## 601	2943.90588	-102.56780	-49.426560	-2.08128683

## 602	3290.23213	409.89151	-50.339639	1.62661785
## 603	2669.96157	-100.68295	-40.873256	0.88583331
## 604	2943.90588	-102.56780	-49.426560	-2.08128683
## 605	1290.22331	-98.19903	-32.090643	0.80196076
## 606	-2027.58201	-80.40293	13.659637	0.55066529
## 607	3928.63731	151.29274	-61.370932	-1.66241301
## 608	-797.55799	306.20376	-52.496282	1.30367842
## 609	-2024.60307	-80.38412	14.013976	0.54988595
## 610	-2023.61009	-80.37785	14.132089	0.54962617
## 611	2669.96157	-100.68295	-40.873256	0.88583331
## 612	1290.22331	-98.19903	-32.090643	0.80196076
## 613	1290.22331	-98.19903	-32.090643	0.80196076
## 614	-2028.57499	-80.40920	13.541524	0.55092507
## 615	1969.48929	164.93198	-67.211680	-0.71919119
## 616	-2029.56798	-80.41547	13.423411	0.55118485
## 617	-2026.58903	-80.39666	13.777750	0.55040551
## 618	-11244.42712	-33.02812	71.638107	-1.96637478
## 619	3548.29217	19.47147	-48.655709	-1.89118164
## 620	-2030.56096	-80.42174	13.305298	0.55144463
## 621	-5761.59480	-58.15884	44.656334	-1.67467355
## 622	-1517.35387	47.42585	-15.539795	-2.17609326
## 623	-2024.60307	-80.38412	14.013976	0.54988595
## 624	-2024.60307	-80.38412	14.013976	0.54988595
## 625	-2027.58201	-80.40293	13.659637	0.55066529
## 626	-2029.56798	-80.41547	13.423411	0.55118485
## 627	-2023.61009	-80.37785	14.132089	0.54962617
## 628	1290.22331	-98.19903	-32.090643	0.80196076
## 629	1290.22331	-98.19903	-32.090643	0.80196076
## 630	1290.22331	-98.19903	-32.090643	0.80196076
## 631	-94.70509	931.89339	-118.899443	0.35459239
## 632	-2026.58903	-80.39666	13.777750	0.55040551
## 633	1284.96936	157.04231	-52.276769	-1.80121460
## 634	2881.97075	-88.14652	157.244630	0.38553480
## 635	3928.63731	151.29274	-61.370932	-1.66241301
## 636	-2031.55394	-80.42801	13.187184	0.55170441
## 637	-2032.54692	-80.43428	13.069071	0.55196419
## 638	3982.71172	-110.49561	-44.888706	-2.05594755
## 639	1969.48929	164.93198	-67.211680	-0.71919119
## 640	-2027.58201	-80.40293	13.659637	0.55066529
## 641	2673.93350	-100.65786	-40.400804	0.88479420
## 642	2073.25935	550.38810	-62.624469	1.79199025
## 643	1290.22331	-98.19903	-32.090643	0.80196076
## 644	204.86570	-90.65079	-43.174253	-1.20864131
## 645	-2029.56798	-80.41547	13.423411	0.55118485
## 646	3982.71172	-110.49561	-44.888706	-2.05594755
## 647	-2029.56798	-80.41547	13.423411	0.55118485
## 648	-2032.54692	-80.43428	13.069071	0.55196419
## 649	3928.63731	151.29274	-61.370932	-1.66241301
## 650	3982.71172	-110.49561	-44.888706	-2.05594755
## 651	-2027.58201	-80.40293	13.659637	0.55066529
## 652	-2032.54692	-80.43428	13.069071	0.55196419
## 653	1969.48929	164.93198	-67.211680	-0.71919119
## 654	-2023.61009	-80.37785	14.132089	0.54962617
## 655	2561.23781	544.99622	-100.885826	1.90909141

## 656	-3970.53348	-56.44385	57.361351	-1.62327145
## 657	-2029.56798	-80.41547	13.423411	0.55118485
## 658	-94.70509	931.89339	-118.899443	0.35459239
## 659	-94.70509	931.89339	-118.899443	0.35459239
## 660	-2026.58903	-80.39666	13.777750	0.55040551
## 661	-60.09433	-87.99902	-25.534828	-1.26425523
## 662	2943.90588	-102.56780	-49.426560	-2.08128683
## 663	2881.97075	-88.14652	157.244630	0.38553480
## 664	-11246.41309	-33.04066	71.401881	-1.96585522
## 665	-2030.56096	-80.42174	13.305298	0.55144463
## 666	204.86570	-90.65079	-43.174253	-1.20864131
## 667	3928.63731	151.29274	-61.370932	-1.66241301
## 668	-2029.56798	-80.41547	13.423411	0.55118485
## 669	1290.22331	-98.19903	-32.090643	0.80196076
## 670	2669.96157	-100.68295	-40.873256	0.88583331
## 671	2881.97075	-88.14652	157.244630	0.38553480
## 672	-2028.57499	-80.40920	13.541524	0.55092507
## 673	1290.22331	-98.19903	-32.090643	0.80196076
## 674	-2025.59605	-80.39039	13.895863	0.55014573
## 675	-2032.54692	-80.43428	13.069071	0.55196419
## 676	1290.22331	-98.19903	-32.090643	0.80196076
## 677	-636.67509	-77.22657	-21.593475	-2.28693440
## 678	-2029.56798	-80.41547	13.423411	0.55118485
## 679	2073.25935	550.38810	-62.624469	1.79199025
## 680	-797.55799	306.20376	-52.496282	1.30367842
## 681	2459.86811	23.80759	-50.717559	-1.93023522
## 682	2673.93350	-100.65786	-40.400804	0.88479420
## 683	-2032.54692	-80.43428	13.069071	0.55196419
## 684	3928.63731	151.29274	-61.370932	-1.66241301
## 685	43.31918	932.76506	-102.481724	0.31848309
## 686	-2025.59605	-80.39039	13.895863	0.55014573
## 687	2074.25233	550.39438	-62.506356	1.79173047
## 688	3982.71172	-110.49561	-44.888706	-2.05594755
## 689	2881.97075	-88.14652	157.244630	0.38553480
## 690	-2025.59605	-80.39039	13.895863	0.55014573
## 691	2669.96157	-100.68295	-40.873256	0.88583331
## 692	2660.03177	-100.74566	-42.054387	0.88843110
## 693	3294.20405	409.91659	-49.867187	1.62557873
## 694	-2029.56798	-80.41547	13.423411	0.55118485
## 695	2074.25233	550.39438	-62.506356	1.79173047
## 696	1290.22331	-98.19903	-32.090643	0.80196076
## 697	-2027.58201	-80.40293	13.659637	0.55066529
## 698	-2027.58201	-80.40293	13.659637	0.55066529
## 699	3982.71172	-110.49561	-44.888706	-2.05594755
## 700	-2030.56096	-80.42174	13.305298	0.55144463
## 701	2477.35621	27.45713	-53.997838	1.08422258
## 702	2943.90588	-102.56780	-49.426560	-2.08128683
## 703	-2024.60307	-80.38412	14.013976	0.54988595
## 704	-510.64680	-81.39849	28.210612	-2.41918903
## 705	-797.55799	306.20376	-52.496282	1.30367842
## 706	-2028.57499	-80.40920	13.541524	0.55092507
## 707	-2023.61009	-80.37785	14.132089	0.54962617
## 708	2660.03177	-100.74566	-42.054387	0.88843110
## 709	3982.71172	-110.49561	-44.888706	-2.05594755

## 710	-727.47136	-86.21159	-36.701673	-1.26303344
## 711	-2030.56096	-80.42174	13.305298	0.55144463
## 712	2881.97075	-88.14652	157.244630	0.38553480
## 713	-2026.58903	-80.39666	13.777750	0.55040551
## 714	2881.97075	-88.14652	157.244630	0.38553480
## 715	1290.22331	-98.19903	-32.090643	0.80196076
## 716	3982.71172	-110.49561	-44.888706	-2.05594755
## 717	386.60471	-91.00224	-38.613505	-2.21283900
## 718	-1106.29302	-83.04182	-18.563990	-2.32454967
## 719	3982.71172	-110.49561	-44.888706	-2.05594755
## 720	828.72350	1786.25687	826.763970	-1.96864291
## 721	-2028.57499	-80.40920	13.541524	0.55092507
## 722	-2025.59605	-80.39039	13.895863	0.55014573
## 723	-2028.57499	-80.40920	13.541524	0.55092507
## 724	204.86570	-90.65079	-43.174253	-1.20864131
## 725	2881.97075	-88.14652	157.244630	0.38553480
## 726	-2032.54692	-80.43428	13.069071	0.55196419
## 727	3972.75335	29.06183	-10.910141	-1.95903539
## 728	-13120.78098	-31.81447	-3.079646	-1.85283575
## 729	3626.52463	18.63750	-54.389840	1.12658253
## 730	-2028.57499	-80.40920	13.541524	0.55092507
## 731	-2025.59605	-80.39039	13.895863	0.55014573
## 732	1243.23544	292.69185	-64.211480	-1.58890523
## 733	-2030.56096	-80.42174	13.305298	0.55144463
## 734	-2030.56096	-80.42174	13.305298	0.55144463
## 735	-861.16885	-83.61218	-13.483307	-2.32748699
## 736	2881.97075	-88.14652	157.244630	0.38553480
## 737	2660.03177	-100.74566	-42.054387	0.88843110
## 738	-2029.56798	-80.41547	13.423411	0.55118485
## 739	1290.22331	-98.19903	-32.090643	0.80196076
## 740	3294.20405	409.91659	-49.867187	1.62557873
## 741	-2029.56798	-80.41547	13.423411	0.55118485
## 742	2673.93350	-100.65786	-40.400804	0.88479420
## 743	-678.86265	-86.61075	-38.945215	-1.25535325
## 744	-2024.60307	-80.38412	14.013976	0.54988595
## 745	2670.95455	-100.67668	-40.755143	0.88557353
## 746	2048.75475	287.98135	-79.749693	-1.51663335
## 747	1290.22331	-98.19903	-32.090643	0.80196076
## 748	-797.55799	306.20376	-52.496282	1.30367842
## 749	-862.16183	-83.61845	-13.601420	-2.32722721
## 750	-2031.55394	-80.42801	13.187184	0.55170441
## 751	-2028.57499	-80.40920	13.541524	0.55092507
## 752	3928.63731	151.29274	-61.370932	-1.66241301
## 753	2669.96157	-100.68295	-40.873256	0.88583331
## 754	-2030.56096	-80.42174	13.305298	0.55144463
## 755	-2027.58201	-80.40293	13.659637	0.55066529
## 756	-2028.57499	-80.40920	13.541524	0.55092507
## 757	-678.86265	-86.61075	-38.945215	-1.25535325
## 758	-2023.61009	-80.37785	14.132089	0.54962617
## 759	-2023.61009	-80.37785	14.132089	0.54962617
## 760	2944.89886	-102.56153	-49.308447	-2.08154661
## 761	-2025.59605	-80.39039	13.895863	0.55014573
## 762	2673.93350	-100.65786	-40.400804	0.88479420
## 763	-2030.56096	-80.42174	13.305298	0.55144463

## 764	-861.16885	-83.61218	-13.483307	-2.32748699
## 765	-2024.60307	-80.38412	14.013976	0.54988595
## 766	1290.22331	-98.19903	-32.090643	0.80196076
## 767	204.86570	-90.65079	-43.174253	-1.20864131
## 768	-2030.56096	-80.42174	13.305298	0.55144463
## 769	3928.63731	151.29274	-61.370932	-1.66241301
## 770	-861.16885	-83.61218	-13.483307	-2.32748699
## 771	-862.16183	-83.61845	-13.601420	-2.32722721
## 772	-60.09433	-87.99902	-25.534828	-1.26425523
## 773	-2026.58903	-80.39666	13.777750	0.55040551
## 774	-1517.35387	47.42585	-15.539795	-2.17609326
## 775	2881.97075	-88.14652	157.244630	0.38553480
## 776	-2027.58201	-80.40293	13.659637	0.55066529
## 777	-460.78493	-79.75959	49.189310	-2.47047803
## 778	-2032.54692	-80.43428	13.069071	0.55196419
## 779	1969.48929	164.93198	-67.211680	-0.71919119
## 780	1205.86131	-74.00184	193.264501	-1.76882342
## 781	3007.11038	579.61378	382.040459	0.69175765
## 782	204.86570	-90.65079	-43.174253	-1.20864131
## 783	-2024.60307	-80.38412	14.013976	0.54988595
## 784	-8318.51419	1227.36724	-23.843966	-0.88132880
## 785	-2030.56096	-80.42174	13.305298	0.55144463
## 786	2669.96157	-100.68295	-40.873256	0.88583331
## 787	2666.98263	-100.70176	-41.227595	0.88661265
## 788	2669.96157	-100.68295	-40.873256	0.88583331
## 789	-2028.57499	-80.40920	13.541524	0.55092507
## 790	-797.55799	306.20376	-52.496282	1.30367842
## 791	1969.48929	164.93198	-67.211680	-0.71919119
## 792	2653.83757	-100.60555	-40.790143	-1.11503873
## 793	1969.48929	164.93198	-67.211680	-0.71919119
## 794	-60.09433	-87.99902	-25.534828	-1.26425523
## 795	-60.09433	-87.99902	-25.534828	-1.26425523
## 796	-2027.58201	-80.40293	13.659637	0.55066529
## 797	-2028.57499	-80.40920	13.541524	0.55092507
## 798	2660.03177	-100.74566	-42.054387	0.88843110
## 799	3972.75335	29.06183	-10.910141	-1.95903539
## 800	-60.09433	-87.99902	-25.534828	-1.26425523
## 801	-2026.58903	-80.39666	13.777750	0.55040551
## 802	-2030.56096	-80.42174	13.305298	0.55144463
## 803	3982.71172	-110.49561	-44.888706	-2.05594755
## 804	2660.03177	-100.74566	-42.054387	0.88843110
## 805	2881.97075	-88.14652	157.244630	0.38553480
## 806	3294.20405	409.91659	-49.867187	1.62557873
## 807	2459.86811	23.80759	-50.717559	-1.93023522
## 808	1969.48929	164.93198	-67.211680	-0.71919119
## 809	1290.22331	-98.19903	-32.090643	0.80196076
## 810	2881.97075	-88.14652	157.244630	0.38553480
## 811	-2027.58201	-80.40293	13.659637	0.55066529
## 812	-2030.56096	-80.42174	13.305298	0.55144463
## 813	-2024.60307	-80.38412	14.013976	0.54988595
## 814	-2028.57499	-80.40920	13.541524	0.55092507
## 815	-2028.57499	-80.40920	13.541524	0.55092507
## 816	-2030.56096	-80.42174	13.305298	0.55144463
## 817	2943.90588	-102.56780	-49.426560	-2.08128683

## 818	2660.03177	-100.74566	-42.054387	0.88843110
## 819	-16539.53626	229.60737	-205.282180	-2.12151426
## 820	2881.97075	-88.14652	157.244630	0.38553480
## 821	2881.97075	-88.14652	157.244630	0.38553480
## 822	-51.90585	-86.13295	-26.740794	-0.25815356
## 823	-2026.58903	-80.39666	13.777750	0.55040551
## 824	2670.95455	-100.67668	-40.755143	0.88557353
## 825	2073.25935	550.38810	-62.624469	1.79199025
## 826	2881.97075	-88.14652	157.244630	0.38553480
## 827	-2030.56096	-80.42174	13.305298	0.55144463
## 828	-2030.56096	-80.42174	13.305298	0.55144463
## 829	2673.93350	-100.65786	-40.400804	0.88479420
## 830	-2023.61009	-80.37785	14.132089	0.54962617
## 831	2881.97075	-88.14652	157.244630	0.38553480
## 832	2673.93350	-100.65786	-40.400804	0.88479420
## 833	2459.86811	23.80759	-50.717559	-1.93023522
## 834	-2023.61009	-80.37785	14.132089	0.54962617
## 835	-2026.58903	-80.39666	13.777750	0.55040551
## 836	-2029.56798	-80.41547	13.423411	0.55118485
## 837	2660.03177	-100.74566	-42.054387	0.88843110
## 838	-797.55799	306.20376	-52.496282	1.30367842
## 839	3928.63731	151.29274	-61.370932	-1.66241301
## 840	1290.22331	-98.19903	-32.090643	0.80196076
## 841	2623.46186	851.85873	468.799845	-2.19051937
## 842	-2030.56096	-80.42174	13.305298	0.55144463
## 843	2943.90588	-102.56780	-49.426560	-2.08128683
## 844	1290.22331	-98.19903	-32.090643	0.80196076
## 845	-2032.54692	-80.43428	13.069071	0.55196419
## 846	-2024.60307	-80.38412	14.013976	0.54988595
## 847	2881.97075	-88.14652	157.244630	0.38553480
## 848	2881.97075	-88.14652	157.244630	0.38553480
## 849	-2028.57499	-80.40920	13.541524	0.55092507
## 850	2673.93350	-100.65786	-40.400804	0.88479420
## 851	-1517.35387	47.42585	-15.539795	-2.17609326
## 852	204.86570	-90.65079	-43.174253	-1.20864131
## 853	1290.22331	-98.19903	-32.090643	0.80196076
## 854	-2033.53990	-80.44056	12.950958	0.55222396
## 855	1290.22331	-98.19903	-32.090643	0.80196076
## 856	-797.55799	306.20376	-52.496282	1.30367842
## 857	-2025.59605	-80.39039	13.895863	0.55014573
## 858	-797.55799	306.20376	-52.496282	1.30367842
## 859	-2025.59605	-80.39039	13.895863	0.55014573
## 860	-2024.60307	-80.38412	14.013976	0.54988595
## 861	1290.22331	-98.19903	-32.090643	0.80196076
## 862	-2026.58903	-80.39666	13.777750	0.55040551
## 863	-2025.59605	-80.39039	13.895863	0.55014573
## 864	1290.22331	-98.19903	-32.090643	0.80196076
## 865	2669.96157	-100.68295	-40.873256	0.88583331
## 866	2669.96157	-100.68295	-40.873256	0.88583331
## 867	204.86570	-90.65079	-43.174253	-1.20864131
## 868	3928.63731	151.29274	-61.370932	-1.66241301
## 869	-2026.58903	-80.39666	13.777750	0.55040551
## 870	1969.48929	164.93198	-67.211680	-0.71919119
## 871	1290.22331	-98.19903	-32.090643	0.80196076

## 872	2817.57725	22.18290	-52.308747	-1.91163404
## 873	-460.78493	-79.75959	49.189310	-2.47047803
## 874	204.86570	-90.65079	-43.174253	-1.20864131
## 875	3928.63731	151.29274	-61.370932	-1.66241301
## 876	-2025.59605	-80.39039	13.895863	0.55014573
## 877	-797.55799	306.20376	-52.496282	1.30367842
## 878	2881.97075	-88.14652	157.244630	0.38553480
## 879	-2025.59605	-80.39039	13.895863	0.55014573
## 880	-2028.57499	-80.40920	13.541524	0.55092507
## 881	2073.25935	550.38810	-62.624469	1.79199025
## 882	2944.89886	-102.56153	-49.308447	-2.08154661
## 883	2074.25233	550.39438	-62.506356	1.79173047
## 884	-2023.61009	-80.37785	14.132089	0.54962617
## 885	-2026.58903	-80.39666	13.777750	0.55040551
## 886	1290.22331	-98.19903	-32.090643	0.80196076
## 887	-550.75205	35.86443	-55.705012	-2.04007781
## 888	2944.89886	-102.56153	-49.308447	-2.08154661
## 889	-59.10135	-87.99275	-25.416715	-1.26451501
## 890	3294.20405	409.91659	-49.867187	1.62557873
## 891	-2023.61009	-80.37785	14.132089	0.54962617
## 892	-2025.59605	-80.39039	13.895863	0.55014573
## 893	-59.10135	-87.99275	-25.416715	-1.26451501
## 894	3982.71172	-110.49561	-44.888706	-2.05594755
## 895	-2029.56798	-80.41547	13.423411	0.55118485
## 896	2669.96157	-100.68295	-40.873256	0.88583331
## 897	204.86570	-90.65079	-43.174253	-1.20864131
## 898	-2024.60307	-80.38412	14.013976	0.54988595
## 899	2074.25233	550.39438	-62.506356	1.79173047
## 900	1969.48929	164.93198	-67.211680	-0.71919119
## 901	3928.63731	151.29274	-61.370932	-1.66241301
## 902	2660.03177	-100.74566	-42.054387	0.88843110
## 903	-2029.56798	-80.41547	13.423411	0.55118485
## 904	-2023.61009	-80.37785	14.132089	0.54962617
## 905	2673.93350	-100.65786	-40.400804	0.88479420
## 906	2669.96157	-100.68295	-40.873256	0.88583331
## 907	3928.63731	151.29274	-61.370932	-1.66241301
## 908	1290.22331	-98.19903	-32.090643	0.80196076
## 909	-1517.35387	47.42585	-15.539795	-2.17609326
## 910	2881.97075	-88.14652	157.244630	0.38553480
## 911	2881.97075	-88.14652	157.244630	0.38553480
## 912	-2028.57499	-80.40920	13.541524	0.55092507
## 913	-2025.59605	-80.39039	13.895863	0.55014573
## 914	2198.37847	70.89216	426.439365	-3.14818679
## 915	2881.97075	-88.14652	157.244630	0.38553480
## 916	-2032.54692	-80.43428	13.069071	0.55196419
## 917	-2024.60307	-80.38412	14.013976	0.54988595
## 918	-2024.60307	-80.38412	14.013976	0.54988595
## 919	-2023.61009	-80.37785	14.132089	0.54962617
## 920	-2023.61009	-80.37785	14.132089	0.54962617
## 921	1290.22331	-98.19903	-32.090643	0.80196076
## 922	-2029.56798	-80.41547	13.423411	0.55118485
## 923	2449.30742	-99.68921	-40.041728	-2.12526661
## 924	3294.20405	409.91659	-49.867187	1.62557873
## 925	-2027.58201	-80.40293	13.659637	0.55066529

## 926	3928.63731	151.29274	-61.370932	-1.66241301
## 927	-1106.29302	-83.04182	-18.563990	-2.32454967
## 928	2669.96157	-100.68295	-40.873256	0.88583331
## 929	-2025.59605	-80.39039	13.895863	0.55014573
## 930	-2029.56798	-80.41547	13.423411	0.55118485
## 931	-2032.54692	-80.43428	13.069071	0.55196419
## 932	-2023.61009	-80.37785	14.132089	0.54962617
## 933	1290.22331	-98.19903	-32.090643	0.80196076
## 934	2881.97075	-88.14652	157.244630	0.38553480
## 935	-2023.61009	-80.37785	14.132089	0.54962617
## 936	1290.22331	-98.19903	-32.090643	0.80196076
## 937	-2030.56096	-80.42174	13.305298	0.55144463
## 938	-2029.56798	-80.41547	13.423411	0.55118485
## 939	2817.57725	22.18290	-52.308747	-1.91163404
## 940	-2024.60307	-80.38412	14.013976	0.54988595
## 941	2669.96157	-100.68295	-40.873256	0.88583331
## 942	-2028.57499	-80.40920	13.541524	0.55092507
## 943	-2032.54692	-80.43428	13.069071	0.55196419
## 944	-1517.35387	47.42585	-15.539795	-2.17609326
## 945	-2026.58903	-80.39666	13.777750	0.55040551
## 946	-2025.59605	-80.39039	13.895863	0.55014573
## 947	2048.75475	287.98135	-79.749693	-1.51663335
## 948	2673.93350	-100.65786	-40.400804	0.88479420
## 949	-2025.59605	-80.39039	13.895863	0.55014573
## 950	2673.93350	-100.65786	-40.400804	0.88479420
## 951	204.86570	-90.65079	-43.174253	-1.20864131
## 952	4007.44361	20.88308	-56.590347	-1.84692790
## 953	-2032.54692	-80.43428	13.069071	0.55196419
## 954	3928.63731	151.29274	-61.370932	-1.66241301
## 955	-2025.59605	-80.39039	13.895863	0.55014573
## 956	1290.22331	-98.19903	-32.090643	0.80196076
## 957	-2030.56096	-80.42174	13.305298	0.55144463
## 958	1290.22331	-98.19903	-32.090643	0.80196076
## 959	2673.93350	-100.65786	-40.400804	0.88479420
## 960	3929.74850	151.21149	-62.241940	-1.66015409
## 961	1312.20371	-94.16132	-30.837172	-1.19493291
## 962	3929.74850	151.21149	-62.241940	-1.66015409
## 963	43.31918	932.76506	-102.481724	0.31848309
## 964	-2028.57499	-80.40920	13.541524	0.55092507
## 965	2561.85665	1612.95198	353.664566	2.13682601
## 966	-2026.58903	-80.39666	13.777750	0.55040551
## 967	-2029.56798	-80.41547	13.423411	0.55118485
## 968	2673.93350	-100.65786	-40.400804	0.88479420
## 969	2881.97075	-88.14652	157.244630	0.38553480
## 970	-2023.61009	-80.37785	14.132089	0.54962617
## 971	2673.93350	-100.65786	-40.400804	0.88479420
## 972	-797.55799	306.20376	-52.496282	1.30367842
## 973	43.31918	932.76506	-102.481724	0.31848309
## 974	-2026.58903	-80.39666	13.777750	0.55040551
## 975	3928.63731	151.29274	-61.370932	-1.66241301
## 976	-473.67049	-88.75596	-53.664759	-2.20959491
## 977	-2032.54692	-80.43428	13.069071	0.55196419
## 978	2881.97075	-88.14652	157.244630	0.38553480
## 979	-2027.58201	-80.40293	13.659637	0.55066529

```
## 980    -2025.59605   -80.39039    13.895863   0.55014573
## 981     -473.67049   -88.75596   -53.664759  -2.20959491
## 982      165.34514   -82.31224   -41.560626  -2.20354860
## 983    -2026.58903   -80.39666    13.777750   0.55040551
## 984     2669.96157  -100.68295   -40.873256   0.88583331
## 985    -2027.58201   -80.40293    13.659637   0.55066529
## 986     2670.95455  -100.67668   -40.755143   0.88557353
## 987     3280.51078   670.72422   -75.590699   2.04424368
## 988     2669.96157  -100.68295   -40.873256   0.88583331
## 989    -2027.58201   -80.40293    13.659637   0.55066529
## 990     2669.96157  -100.68295   -40.873256   0.88583331
## 991    -2026.58903   -80.39666    13.777750   0.55040551
## 992     2881.97075   -88.14652   157.244630   0.38553480
## 993    -2025.59605   -80.39039    13.895863   0.55014573
## 994   -11412.06571   -23.99814    75.066434  -2.97110801
## 995     3928.63731   151.29274   -61.370932  -1.66241301
## 996    -2023.61009   -80.37785    14.132089   0.54962617
## 997     2881.97075   -88.14652   157.244630   0.38553480
## 998     1290.22331   -98.19903   -32.090643   0.80196076
## 999    -2028.57499   -80.40920    13.541524   0.55092507
## 1000   -2030.56096   -80.42174    13.305298   0.55144463
```

```
#-----Performing Simple Orthogonal Regression-Also called as total least squares-----
#To create a linear model using orthogonal regression in which variances of C18 and C19
# are treated symmetrically in order to implement a basic orthogonal regression in R,
# we perform PCA
```

```
r <- prcomp( ~ actualdata$C18 + actualdata$C19 )
#Now, using the rotations to compute the slope:
slope <- r$rotation[2,1] / r$rotation[1,1]
#Now, calculating the intercept from the slope:
intercept <- r$center[2] - slope*r$center[1]
```

```
#-----Finding Clusters in the Data-----
```

```
#creating a subset of the actual clickthrough data set to include only numerical variables
# to understand clustering
```

```
#d<-dist(x)      #Compute distances between observations
#hc <- hclust(d)  #Form hierarchical clusters
```

```
#the result clust below is the vector of numbers between 1 and 3, one for each observation in x
#Each number classifies its corresponding observation into one of the n clusters.
#clust <- cutree(hc, k=3)  #Organize them into the 3 largest clusters
```

```
#-----Predicting a Binary-Valued Variable (Logistic Regression)-----
#A regression model to predict the probability of a binary event occurring
```

```
# install.packages("faraway")
# library(faraway)
#
# #Faraway gives an example of predicting a binary-valued variable:
# #test from the dataset pima is true if the patient tested positive for diabetes.
```

```

#
# data(pima, package="faraway")
# b <- factor(pima$test)
#
# #The predictors are diastolic blood pressure and body mass index (BMI).
# m <- glm(b ~ diastolic + bmi, family=binomial, data=pima)
#
# summary(m)    #results show that only the bmi variable is significant, p-value for it is
# # 1.95e-14
#
# #Since only bmi variable is significant, a reduced model can be created like below:
# m.red <- glm(b ~ bmi, family=binomial, data=pima)
#
#
# #Now using the model to calculate the probability that someone with an avg BMI(32.0)
# # will test positive for diabetes
# newdata <- data.frame(bmi=32.0)
#
# predict(m.red, type="response", newdata=newdata)
# #According to this model, the probability is about 33.3%

#-----Factor Analysis-----

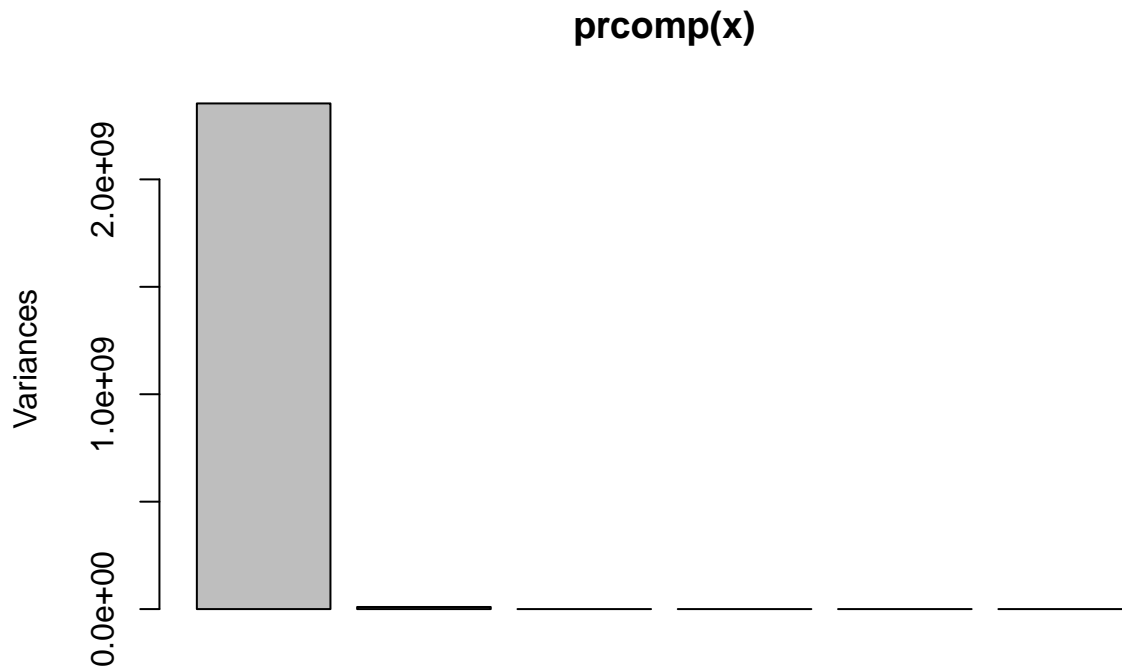
#in order to discover what the variables in a dataset have in common, we use the factanal
# function

#creating a subset of the actual clickthrough data set to include only numerical variables
# since factor analysis is for numerical ones

x<-data.frame(actualdata$C14, actualdata$C18, actualdata$C19, actualdata$C17, actualdata$C20,
              actualdata$C21)

#Plotting the PCA to see the variance captured by the components
plot(prcomp(x))

```



```
factanal(x,factors=2) #The p-value is 9.4e-12. Small p-value (<0.05) indicates that the two
```

```
##
## Call:
## factanal(x = x, factors = 2)
##
## Uniquenesses:
## actualdata.C14 actualdata.C18 actualdata.C19 actualdata.C17 actualdata.C20
##          0.005          0.464          0.858          0.045          0.914
## actualdata.C21
##          0.220
##
## Loadings:
##          Factor1 Factor2
## actualdata.C14  0.997
## actualdata.C18  0.135  0.719
## actualdata.C19          0.372
## actualdata.C17  0.977
## actualdata.C20          0.290
## actualdata.C21  0.377 -0.799
##
##          Factor1 Factor2
## SS loadings    2.115  1.378
## Proportion Var  0.353  0.230
## Cumulative Var  0.353  0.582
```

```
##  
## Test of the hypothesis that 2 factors are sufficient.  
## The chi square statistic is 95.99 on 4 degrees of freedom.  
## The p-value is 7.03e-20
```

```
# factors are insufficient
```

```
#In cases where p-value>0.05, it will help us to conclude that factors are sufficient  
#and % of individual variance and cumulative variance they explain
```