Gregory Campbell

Exercise 1: Missing Data

a. Number of Students:

[1] 340823

b. Number of Schools:

[1] 640

c. Number of Programs:

[1] 33

d. Number of Choices:

[1] 2773

e. Missing Test Scores:

[1] 179887

f. Apply to the Same School:

[1] 663

g. Apply to Less than 6 Choices:

[1] 17734

Exercise 2: Data

Dataset I created:

	pgm	schoolcode	sssdistrict	ssslong	ssslat	cutoff	quality	size
1	Agriculture	10101	Accra Metropolitan	-0.1971153	5.607396	288	310.1429	49
2	Business	10101	Accra Metropolitan	-0.1971153	5.607396	305	324.8600	100
3	General Arts	10101	Accra Metropolitan	-0.1971153	5.607396	316	330.0900	100
4	General Science	10101	Accra Metropolitan	-0.1971153	5.607396	299	329.1000	50
5	Home Economics	10101	Accra Metropolitan	-0.1971153	5.607396	284	300.5714	49
6	Technical	10101	Accra Metropolitan	-0.1971153	5.607396	NA	NA	NA
7	Visual Arts	10101	Accra Metropolitan	-0.1971153	5.607396	296	311.5400	50
8	General Arts	10102	Accra Metropolitan	-0.1971153	5.607396	388	404.9773	88
9	General Science	10102	Accra Metropolitan	-0.1971153	5.607396	389	406.4143	70
10	Home Economics	10102	Accra Metropolitan	-0.1971153	5.607396	363	377.1111	45
11	Visual Arts	10102	Accra Metropolitan	-0.1971153	5.607396	343	370.9333	45
12	Agriculture	10103	Accra Metropolitan	-0.1971153	5.607396	316	333.1316	38
13	Business	10103	Accra Metropolitan	-0.1971153	5.607396	341	357.9664	119
14	General Arts	10103	Accra Metropolitan	-0.1971153	5.607396	349	362.5812	117
15	General Science	10103	Accra Metropolitan	-0.1971153	5.607396	335	353.5625	80
16	Home Economics	10103	Accra Metropolitan	-0.1971153	5.607396	320	336.0408	49
17	Visual Arts	10103	Accra Metropolitan	-0.1971153	5.607396	343	357.9500	40
18	General Arts	10104	Accra Metropolitan	-0.1971153	5.607396	302	320.1273	55
19	General Science	10104	Accra Metropolitan	-0.1971153	5.607396	245	283.3636	55
20	Home Economics	10104	Accra Metropolitan	-0.1971153	5.607396	264	285.8545	55

Exercise 3: Distance

Distance dataset for admitted students:

	X	jssdistrict	sssdistrict	distance
1	179888	Agona Swedru	Abura/Asebu/Kwamankese (Abura Dunkwa)	45.40499
2	179890	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
3	179891	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000

4	179892	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
5	179893	Ajumako/Enyan/Essiam (Ajumako)	Abura/Asebu/Kwamankese (Abura Dunkwa)	22.96873
6	179894	Twifo Hemang (Twifo Praso)	Abura/Asebu/Kwamankese (Abura Dunkwa)	39.52487
7	179895	Awutu/Efutu/Senya (Winneba)	Abura/Asebu/Kwamankese (Abura Dunkwa)	55.41003
8	179896	Mfantsiman (Saltpond)	Abura/Asebu/Kwamankese (Abura Dunkwa)	14.03343
9	179897	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
10	179898	Mfantsiman (Saltpond)	Abura/Asebu/Kwamankese (Abura Dunkwa)	14.03343
11	179899	Mfantsiman (Saltpond)	Abura/Asebu/Kwamankese (Abura Dunkwa)	14.03343
12	179900	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
13	179901	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
14	179902	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
15	179903	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
16	179904	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000
17	179905	Berekum	Abura/Asebu/Kwamankese (Abura Dunkwa)	191.40718
18	179907	Assin South (Nsuaem Kyekyewere)	Abura/Asebu/Kwamankese (Abura Dunkwa)	25.72326
19	179909	Awutu/Efutu/Senya (Winneba)	Abura/Asebu/Kwamankese (Abura Dunkwa)	55.41003
20	179910	Abura/Asebu/Kwamankese (Abura Dunkwa)	Abura/Asebu/Kwamankese (Abura Dunkwa)	0.00000

Distance dataset between all junior and senior schools:

	jssdistrict	jsslong	jsslat	sssdistrict	ssslong	ssslat
1	South Dayi (Kpeve)	0.2076307	6.375762	Cape Coast Municipal	-1.306594	5.153656
2	Sawla-Tuna-Kalba	-2.3611672	9.407022	Cape Coast Municipal	-1.306594	5.153656
3	Adaklu Anigbe (Kpetoe)	0.4886983	6.383957	Cape Coast Municipal	-1.306594	5.153656
4	talensi-Nabdam (Tongo)	-0.7496063	10.678346	Cape Coast Municipal	-1.306594	5.153656
5	Tain	-2.2868309	7.948905	Cape Coast Municipal	-1.306594	5.153656
6	Amansie Central (Jacobu)	-1.7398577	6.242801	Cape Coast Municipal	-1.306594	5.153656
7	Garu Tempane	-0.1718624	10.822017	Cape Coast Municipal	-1.306594	5.153656
8	Pru	-0.9921895	8.007647	Cape Coast Municipal	-1.306594	5.153656
9	Bunkpurugu Yunyoo (Bunkpurugu)	-0.0841670	10.522129	Cape Coast Municipal	-1.306594	5.153656
10	Adansi North (Fomena)	-1.5687379	6.073349	Cape Coast Municipal	-1.306594	5.153656
11	Atiwa (Kwabeng)	-0.6751719	6.326782	Cape Coast Municipal	-1.306594	5.153656
12	Atwima Mponua (Nyinahin)	-2.1771805	6.549507	Cape Coast Municipal	-1.306594	5.153656
13	Adansi East (New Edubiase)	-1.3965286	6.105482	Cape Coast Municipal	-1.306594	5.153656
14	Adansi West (Obuasi)	-1.6592742	5.986412	Cape Coast Municipal	-1.306594	5.153656
15	Afigya Sekyere (Agona)	-1.5486143	7.001996	Cape Coast Municipal	-1.306594	5.153656
16	Ahafo Ano North (Tepa)	-2.2075796	6.900830	Cape Coast Municipal	-1.306594	5.153656

17	Ahafo Ano South (Mankranso)	-1.9891722	6.928771	Cape Coast Municipal	-1.306594	5.153656
18	Amansie East (Bekwai)	-1.3707289	6.383361	Cape Coast Municipal	-1.306594	5.153656
19	Amansie West (Manso-Nkwanta)	-1.8933699	6.436945	Cape Coast Municipal	-1.306594	5.153656
20	Asante Akim North (Konongo)	-1.0179631	6.834004	Cape Coast Municipal	-1.306594	5.153656

```
     distance
1   134.09647
2   302.88757
3   149.91142
4   384.02474
5   204.68264
6    81.01501
7   399.59954
8   198.58743
9   380.54034
10   66.12296
11   92.02936
12  113.58671
13   66.12962
14   62.50457
15  128.92860
16  135.77239
17  131.42987
18   85.17533
19   97.50087
20  117.91133
```

Exercise 4: Descriptive Characteristics

Average and standard deviation of cutoff, quality, and distance:

```
  mean_cutoff sd_cutoff mean_quality sd_quality mean_distance sd_distance
1    268.3248  52.83939     296.0099   46.02852      31.00918    46.51059
```

Differentiating by students score test quantiles:

```
# A tibble: 10 x 7
   quantile mean_cutoff sd_cutoff mean_quality sd_quality mean_distance sd_distance
 *    <int>       <dbl>     <dbl>        <dbl>      <dbl>         <dbl>       <dbl>
 1        1        210.      9.33         246.       10.7          25.0        40.5
 2        2        220.      14.2         254.       11.5          26.0        44.4
 3        3        230.      18.1         262.       13.3          27.0        46.5
 4        4        240.      21.6         270.       15.5          27.7        47.5
 5        5        251.      24.5         280.       18.3          29.8        49.2
 6        6        266.      26.4         293.       20.4          30.8        49.0
 7        7        279.      27.9         304.       21.9          31.4        46.6
 8        8        296.      30.2         320.       24.0          32.8        46.1
 9        9        325.      29.6         346.       24.6          35.8        45.0
10       10        367.      29.4         385.       26.9          43.8        46.9
```

Exercise 5: Data Creation

X1:
```
[1] 1.575155 2.576610 1.817954 2.766035 2.880935 1.091113 2.056211 2.784838 2.102870 1.913229
[11] 2.913667 1.906668 2.355141 2.145267 1.205849 2.799650 1.492175 1.084119 1.655841 2.909007
```

X2:
```
 [1]  3.559389  3.695663 10.780100  8.316954  6.115934  6.982409  5.664632  3.686255  9.210705
[10]  4.180697  7.075456  4.662065  3.373279  2.323585  5.316899  4.359413  2.597565  3.960450
[19]  2.074180  1.771134
```

X3:
```
 [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 0 0 0 0
```

ε:
```
 [1] 1.77582959 4.36122695 2.08430532 0.34526302 2.06410042 2.31856618 1.28960489 1.66935234
 [9] 0.81856034 2.83272945 2.91611200 1.53790192 2.55427585 2.46618916 2.04074978 3.39632485
[17] 1.66728601 1.60229183 0.06511117 1.66350546
```

Y:

[1] 0.9625656 4.6270623 -4.9362401 -3.3207540 0.5168815 -2.1562662 -0.8411111 2.1935290

[9] -4.4476302 1.8659774 0.5446019 0.1300452 2.9444939 3.4492829 -0.6974400 3.3324330

[17] 1.6200883 -0.1611703 0.6853590 4.0602933

Ydum:

[1] 1 1 0 0 1 0 0 1 0 1 1 1 1 1 0 1 1 1 1 1

Exercise 6: OLS

Correlation:

[1] 0.216015

Coefficients of Regression:

	[,1]
constant	2.4907098
x1	1.1976226
x2	-0.8970514
x3	0.0875850

Standard errors of coefficients:

constant	x1	x2	x3
0.040620200	0.017358550	0.002876599	0.021694530

Exercise 7: Discrete Choice

Linear probability model estimated coefficients:

```
                 [,1]
constant  0.885823611
X1         0.146193985
X2        -0.102832042
X3        -0.008053057
```

Logit model:

```
$par
[1]  5.42655944  2.10059571 -1.61851081 -0.01963077

$value
[1] 2223.017

$counts
function gradient
      69       17

$convergence
[1] 0
```

Probit Model:

```
$par
[1]  3.04275834  1.17235798 -0.90546558 -0.01124998

$value
[1] 2213.313

$counts
function gradient
      80       16

$convergence
[1] 0
```

Exercise 8: Marginal Effects

Marginal effects for logit:

```
                    [,1]
(Intercept)  0.381360316
x1           0.147623207
x2          -0.113743625
x3          -0.001379547
```

Marginal effects for probit:

```
                   [,1]
(Intercept)  0.37324175
```

x1	0.14380827
x2	-0.11106954
x3	-0.00137997

Logit standard errors of marginal effects:

	CF: est	CF: sd	BT: est	BT: sd
(Intercept)	5.42654014	0.18557270	0.2488617787	0.081470019
x1	2.10059417	0.07936026	-0.0001566742	0.036275543
x2	-1.61850702	0.03670791	0.0000561398	0.005768586
x3	-0.01963017	0.08323153	-0.0011466765	0.042383660

Probit standard errors of marginal effects:

	CF: est	CF: sd	BT: est	BT: sd
(Intercept)	3.04273897	0.09980833	1.557768e-01	0.050881621
x1	1.17235282	0.04287054	-9.747113e-05	0.022654641
x2	-0.90546040	0.01856071	3.400791e-05	0.003602752
x3	-0.01124978	0.04651168	-7.241851e-04	0.026468753