A1 Nancun Li

Exercise1

number of student
340823

Number of schools
641(in students school datstu)
898(in all list scholl datsss)

Number of programs
33

Number of choices (school,program
3086

Missing test score
179887

Apply to the same school (di erent programs)
120071

Apply to less than 6 choices
18954

Exercise2

```
> print(school_level[1:20,])
                     sp schoolcode     programcode  sssdistrict  ssslong   ssslat cutoff  quality size
1                100101      100101                 Wa Municipal -2.28503 10.03062     NA       NA   NA
2     100101 General Arts     100101    General Arts Wa Municipal -2.28503 10.03062    198 244.3924   79
3   100101 Home Economics     100101  Home Economics Wa Municipal -2.28503 10.03062    199 229.4500   40
4       100101 Technical      100101       Technical Wa Municipal -2.28503 10.03062    201 235.1020   49
5      100102 Agriculture     100102     Agriculture Wa Municipal -2.28503 10.03062    273 292.5556   90
6         100102 Business     100102        Business Wa Municipal -2.28503 10.03062    283 303.3444   90
7     100102 General Arts     100102    General Arts Wa Municipal -2.28503 10.03062    291 311.1111   90
8  100102 General Science     100102 General Science Wa Municipal -2.28503 10.03062    273 298.4333   90
9   100102 Home Economics     100102  Home Economics Wa Municipal -2.28503 10.03062    262 278.8667   45
10     100102 Visual Arts     100102     Visual Arts Wa Municipal -2.28503 10.03062    250 275.2000   45
11     100103 Agriculture     100103     Agriculture Wa Municipal -2.28503 10.03062     NA       NA   NA
12        100103 Business     100103        Business Wa Municipal -2.28503 10.03062     NA       NA   NA
13    100103 General Arts     100103    General Arts Wa Municipal -2.28503 10.03062     NA       NA   NA
14        100104 Business     100104        Business Wa Municipal -2.28503 10.03062     NA       NA   NA
15    100104 General Arts     100104    General Arts Wa Municipal -2.28503 10.03062    319 337.4444   45
16 100104 General Science     100104 General Science Wa Municipal -2.28503 10.03062    313 334.0000   45
17  100104 Home Economics     100104  Home Economics Wa Municipal -2.28503 10.03062    282 309.3556   45
18                100105      100105                 Wa Municipal -2.28503 10.03062     NA       NA   NA
19        100105 Business     100105        Business Wa Municipal -2.28503 10.03062    251 268.0125   80
20    100105 General Arts     100105    General Arts Wa Municipal -2.28503 10.03062    258 274.7375   80
```

Exercise3

I make two form (same information) to report the distance between junior high school, and senior high school.

Long table:

```
> print(dis_js_long[1:20,])
                       sssdis              jssdis         distance
1          Accra Metropolitan South Dayi (Kpeve) 59.9919865044814
2          Ga West (Amasaman) South Dayi (Kpeve)  64.419456204133
3                        Tema South Dayi (Kpeve) 50.6156936613713
4           Dangme East (Ada) South Dayi (Kpeve) 32.6339719947566
5         Dangme West (Dodowa) South Dayi (Kpeve) 45.8446614334538
6            Ga East (Abokobi) South Dayi (Kpeve) 54.7920897810607
7      New Juaben (Koforidua) South Dayi (Kpeve) 39.2072281117157
8        Suhum/Kraboa/Coaltar South Dayi (Kpeve) 55.6049736817609
9      Akwapim South (Nsawam) South Dayi (Kpeve) 50.1630800018662
10   Akwapim North (Akropong) South Dayi (Kpeve) 37.7225740726313
11     West Akim (Asamankese) South Dayi (Kpeve)  67.519365351996
12     Birim South (Akim Oda) South Dayi (Kpeve) 88.2993948724899
13 Birim North ( New Abirem) South Dayi (Kpeve) 85.1675633406139
14 Asuogyaman (Senchi Ferry) South Dayi (Kpeve) 15.2887554205168
15  Kwahu North (Donkorkrom) South Dayi (Kpeve) 49.2951979936485
16      Kwahu South (Mpraeso) South Dayi (Kpeve) 60.3593355374014
17       Kwahu West (Nkawkaw) South Dayi (Kpeve) 70.1887923329991
18         Kwaebibirem (Kade) South Dayi (Kpeve) 71.2056590422866
19         Fanteakwa (Begoro) South Dayi (Kpeve) 38.9767192057032
20           East Akim (Kibi) South Dayi (Kpeve) 47.5074867842705
```

Wide table

	South Dayi (Kpeve)	Sawla-Tuna-Kalba	Adaklu Anigbe (Kpetoe)	talensi-Nabdam (Tongo)	Tain	Amansie Central (Jacobu)	Garu Tempane	Pru	Bunkpurugu Yunyoo (Bunkpurugu)	Adansi North (Fomena)	Atiwa (Kwabeng
Accra Metropolitan	59.9919865044814	301.4755648004	71.4708956482989	352.772463850955	216.167520466649	114.826661466393	360.709848922215	174.734029421112	340.048710754447	99.6990027298264	59.635716
Ga West (Amasaman)	64.419456204133	291.492599700108	78.6557741740557	347.629613948572	204.249917567793	100.592527555565	357.072038706391	167.1078386956	336.674041737628	85.3769645174106	49.617513
Tema	50.6156936613713	301.611571123014	60.6130631598268	348.293072572059	218.834950424205	122.31525316407	355.066493514643	172.796585884228	334.234293731874	107.76630853998	61.523258
Dangme East (Ada)	32.6339719947566	294.485448230094	41.7426955383869	334.61202409811	216.078757243963	128.995695627711	339.974390456881	163.174983925946	318.967428006295	115.775210981194	60.853080
Dangme West (Dodowa)	45.8446614334538	318.091427211222	41.3765971885454	349.099689701476	243.214760982127	158.055650505606	351.422584862642	185.019585639194	330.092920868996	144.518651435529	89.799672
Ga East (Abokobi)	54.7920897810607	293.146825515519	67.9651581998279	344.637072675802	208.295424331554	109.189010694752	352.869051316718	166.318337102323	332.265382198099	94.5108986134824	51.433923
New Juaben (Koforidua)	39.2072281117157	267.884567275152	57.2129722315801	317.31247827057	186.298688744779	99.5863707791006	325.870733547477	139.452640691729	305.359971167884	87.481910757301	29.893459
Suhum/Kraboa/Coaltar	55.6049736817609	271.904798167417	72.8878442077897	327.98015990643	186.091679218672	89.3885793754508	338.014540106404	147.042430098023	317.756305926552	75.7581447050l3	29.809362
Akwapim South (Nsawam)	50.1630800018662	285.932310926226	64.7857724653032	337.23732686679	201.7105211l7838	105.21758472477	345.646331118297	158.847149059958	325.081614378929	91.0741024039564	44.526310
Akwapim North (Akropong)	37.7225740726313	280.626345500776	53.1097143820576	327.650986314288	199.310163883995	109.773942616327	335.179423341482	151.470663251334	314.484697697726	96.7134217005471	42.572297
West Akim (Asamankese)	67.519365351996	274.578157478556	84.5255642389456	335.255913925782	186.063023425999	82.7431506660105	346.334431735425	152.654272659433	326.273242535577	68.0572447449521	34.414409
Birim South (Akim Oda)	88.2993948724899	262.832948403202	106.472594258217	333.340616253962	170.129080060758	59.1130952181l93	347.196279212386	148.277141391436	327.773942095656	43.7056231593829	37.848804
Birim North (New Abirem)	85.1675633406139	238.474535282395	104.424579788433	308.75424013334	147.540780165516	49.4030105066702	323.334787398165	123.478797516598	304.151991155627	39.0230963387841	24.884730
Asuogyaman (Senchi Ferry)	15.2887554205168	278.35991041528	30.6419811020507	315.70175533237	203.205273427466	125.764090494195	320.94638028625	145.943178034935	299.944828679282	114.2608352353S3	53.346599
Kwahu North (Donkorkrom)	49.2951979936485	224.175458821322	63.3741624671143	262.604318288935	155.998803637835	111.497054107387	270.539046617019	90.7043893049589	250.023319095333	106.820488002965	49.345043
Kwahu South (Mpraeso)	60.3593355374014	225.951043630087	78.9777798820048	280.884452055704	145.798845981596	80.2758791520569	292.417252283562	99.098374243047	272.563241120487	74.4720969740309	20.411766
Kwahu West (Nkawkaw)	70.1887923329991	225.849990385693	89.2751083890474	287.177498892677	141.496797653176	67.4206951905954	300.162134126353	103.243276507049	280.62831646082	61.3709478616132	16.366092
Kwaebibirem (Kade)	71.2056590422866	250.286026161746	90.2047341261593	314.406547136434	161.743585434672	65.1343279876887	327.113873504159	130.324307972101	307.451093201001	53.1052086563436	15.862002
Fanteakwa (Begoro)	38.9767192057032	246.891515994915	58.1854512565316	294.663229082042	168.659629976963	96.0847628535386	303.642747697389	117.115703080822	283.245191950495	87.1021913003995	23.202911
East Akim (Kibi)	47.5074867842705	258.464868870554	66.3663602758128	311.905722968952	175.374260818504	88.5059426080387	321.770220908408	131.776382897497	301.506400095707	76.9969428886472	18.319886

Exercise4

for each ranked choice

```
> print(table1)
      avg_cutoff sd_cutoff avg_quality sd_quality avg_distance sd_distance
rank1   317.0717  52.01054     337.9208   46.83908      34.14635     47.71170
rank2   299.6604  48.84759     321.3895   43.17346      32.92892     45.79090
rank3   287.1835  47.11865     310.1029   41.13584      30.67485     43.79528
rank4   273.9045  45.89648     298.6397   39.60251      26.48110     41.63369
rank5   256.5197  31.89327     284.1636   25.75738      30.26231     28.38107
rank6   251.4231  31.62788     279.6407   25.65834      30.84805     28.37482
```

For quantiles 1:

```
> print(table_25)
      avg_cutoff sd_cutoff avg_quality sd_quality avg_distance sd_distance
rank1   283.4534  44.59166     306.7529   38.94246      28.27913     44.89946
rank2   270.0009  41.40760     294.3333   35.90342      28.69947     43.71274
rank3   261.2568  40.43917     286.6283   34.93599      27.67535     42.15750
rank4   251.4020  39.75034     278.2927   34.20236      25.34848     40.95437
rank5   246.8855  31.22731     274.3982   25.74618      29.32590     28.78110
rank6   242.4731  30.73168     270.5157   25.52473      29.82050     28.64225
```

For quantiles 2:

```
> print(table_50)
      avg_cutoff sd_cutoff avg_quality sd_quality avg_distance sd_distance
rank1   301.0173  45.03198     322.7784   39.25254      31.69949     48.20433
rank2   285.1532  42.37029     308.0621   36.63525      31.22761     46.57879
rank3   273.9051  41.35209     298.0751   35.49417      29.81820     45.01575
rank4   262.0434  40.85982     288.0557   34.66926      26.12894     42.53877
rank5   253.4241  31.44824     280.8732   25.36836      29.94637     28.51642
rank6   248.7229  31.12694     276.7619   25.21741      30.73509     28.56983
```

For quantiles 3:

```
> print(table_75)
      avg_cutoff sd_cutoff avg_quality sd_quality avg_distance sd_distance
rank1   323.0130  43.53460    342.9473   38.32348     34.86944    48.94770
rank2   304.1427  42.36073    325.3159   36.63066     33.46690    46.83600
rank3   290.5017  41.65390    313.0342   35.69395     31.35241    44.98074
rank4   276.2045  41.29130    300.7063   34.98959     26.97811    42.57398
rank5   260.0547  31.18633    287.4211   24.47648     30.78063    28.11440
rank6   254.6174  31.21378    282.5944   24.75947     31.30439    28.20151
```

For quantiles 4:

```
> print(table_100)
      avg_cutoff sd_cutoff avg_quality sd_quality avg_distance sd_distance
rank1   362.1617  38.09107    380.4723   34.85716     41.98427    47.69021
rank2   340.5253  38.24956    358.9266   33.94823     38.49917    45.44718
rank3   324.1210  39.78167    343.6262   34.51467     33.97069    42.73751
rank4   306.9100  41.69904    328.3540   35.64904     27.51189    40.39295
rank5   266.4038  30.28669    294.6718   22.71537     31.05815    28.04709
rank6   260.5411  30.53754    289.3772   23.10501     31.59482    28.02791
```

Exercise5

```
> print(X1[1:20])
 [1] 1.798445 2.903185 2.086302 2.525591 2.101677 1.842047 1.935384 2.226587 1.475423 1.509340 2.893761 2.565562 2.233737 1.246480 1.954025 1.577985
[17] 1.271503 2.234595 2.639046 2.511033
> print(X2[1:20])
 [1]  3.148397  8.797671  2.346265  5.281469  8.313521  1.577177  7.005879 12.613128  8.848956  7.934141  7.160875  8.033499  6.490527  7.246744
[15]  3.096426  4.039649  1.240743  2.617350  4.583095  6.526680
> print(X3[1:20])
 [1] 1 1 1 1 0 1 0 0 0 0 0 0 1 1 0 0 0 1 0 1
> print(epi[1:20])
 [1] 1.6173465 2.4622747 3.5709684 2.1767414 1.0291204 1.2474437 2.8677660 3.5301381 3.9532834 1.5412128 2.7549891 2.7729697 1.6049094 2.3745180
[15] 2.0166758 3.4634718 0.9922842 2.2889240 1.8477401 2.1282183
> print(Y[1:20])
 [1]  1.5419231 -1.3718080  4.5628918  1.0541287 -3.4310354  2.6384412 -0.6150653 -4.6497721 -1.7402692 -3.2883061  0.2827147 -0.8785052 -0.9560807
[14] -2.0517759  2.0747222  2.2213691  1.9014189  3.2148224  1.3898098 -0.1325535
> print(ydum[1:20])
 [1] 1 0 1 1 0 1 0 0 0 0 1 0 0 0 1 1 1 1 1 1
```

Exercise6

Correlation:

0.2256845

The correlation is 0.22, is smaller than 1.2

Coeffcients:

1	X1	X2	X3
2.48	1.21	-0.899	0.075

sd:

1	X1	X2	X3
0.04	0.017	0.0028	0.0219

Exercise7

Linear:

```
Call:
lm(formula = ydum ~ X1 + X2 + X3)

Residuals:
     Min       1Q   Median       3Q      Max
-0.92564 -0.28097  0.06534  0.25378  2.21048

Coefficients:
             Estimate Std. Error  t value Pr(>|t|)
(Intercept)  0.8817899  0.0136522   64.590   <2e-16 ***
X1           0.1451709  0.0057910   25.068   <2e-16 ***
X2          -0.1015362  0.0009577 -106.019   <2e-16 ***
X3           0.0129803  0.0073163    1.774   0.0761 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.3344 on 9996 degrees of freedom
Multiple R-squared:  0.5452,    Adjusted R-squared:  0.5451
F-statistic:  3995 on 3 and 9996 DF,  p-value: < 2.2e-16
```

the coeff of X1 X2 X3 is 0.14, -0.1, 0.01。 for X1 X2 is significant, For X3 is not significant.
0.14 means that one unit change in X1 lead to 0.14 unit change in Ydum.
-0.1 means that one unit change in X2 lead to -0.1 unit change in Ydum.

Probit:

```
Call:
glm(formula = ydum ~ X1 + X2 + X3, family = binomial(link = "probit"))

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.7725  -0.1155   0.0092   0.2565   3.1916

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  2.91697    0.09814  29.723   <2e-16 ***
X1           1.21006    0.04337  27.899   <2e-16 ***
X2          -0.88952    0.01804 -49.304   <2e-16 ***
X3           0.09853    0.04693   2.099   0.0358 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 13696.6  on 9999  degrees of freedom
Residual deviance:  4405.2  on 9996  degrees of freedom
AIC: 4413.2

Number of Fisher Scoring iterations: 7
```

the coeff of X1 X2 X3 is 1.2, -0.8, 0.09。 for X1 X2 is significant, For X3 is not significant.
1.2 means that the effect of X1 makes it more likely to increase Ydum.
-0.8 means that the effect of X2 makes it less likely to increase Ydum.

Logit:

```
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-3.3634  -0.1532   0.0416   0.2679   3.0019

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  5.19268    0.18298  28.379   <2e-16 ***
X1           2.18504    0.08100  26.975   <2e-16 ***
X2          -1.59414    0.03589 -44.419   <2e-16 ***
X3           0.17602    0.08442   2.085   0.0371 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 13696.6  on 9999  degrees of freedom
Residual deviance:  4417.9  on 9996  degrees of freedom
AIC: 4425.9

Number of Fisher Scoring iterations: 7
```

the coeff of X1 X2 X3 is 2.18, -1.59, 0.17。 for X1 X2 is significant, For X3 is significant under 95%.

2.18 means that the effect of X1 makes it more likely to increase Ydum.
-1.59 means that the effect of X2 makes it less likely to increase Ydum.

Exercise8

Probit

	marginal effect	standard error
1	0.35639912	0.010219202
X1	0.14784677	0.004843722
X2	-0.10868239	0.001377954
X3	0.01203829	0.005854795

Logit

	marginal effect	standard error
1	0.35239969	0.011484065
X1	0.14828736	0.005430287
X2	-0.10818605	0.002098943
X3	0.01194532	0.006001319