Exercise 1

	month	period	district	tot_pop	tot_white	tot_black	tot_hisp	p50_inc	crime_type	crimes	NUID	tenure	arrest
4430	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	5	66	370	0
4431	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	5	147	203	0
4432	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	5	220	479	1
4433	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	5	256	151	2
4434	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	164	66	370	0
4435	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	164	147	203	0
4436	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	164	220	479	1
4437	2007-01-01	1	1	38472	22608	4953	2543	91084.91	drug	164	256	151	2
4438	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	61	66	370	0
4439	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	61	147	203	0
4440	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	61	220	479	1
4441	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	61	256	151	2
4442	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	227	66	370	0
4443	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	227	147	203	0
4444	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	227	220	479	1
4445	2007-01-01	1	1	38472	22608	4953	2543	91084.91	other	227	256	151	2
4446	2007-01-01	1	1	38472	22608	4953	2543	91084.91	property	547	66	370	0
4447	2007-01-01	1	1	38472	22608	4953	2543	91084.91	property	547	147	203	0
4448	2007-01-01	1	1	38472	22608	4953	2543	91084.91	property	547	220	479	1
4449	2007-01-01	1	1	38472	22608	4953	2543	91084.91	property	547	256	151	2

Exercise 2

	month	crimes
1	2002-01-01	38405
2	2002-02-01	33909
3	2002-03-01	38583
4	2002-04-01	40032
5	2002-05-01	42913
6	2002-06-01	42834
7	2002-07-01	46012
8	2002-08-01	44210
9	2002-09-01	42389
10	2002-10-01	43144
11	2002-11-01	37151
12	2002-12-01	37171
13	2003-01-01	36715
14	2003-02-01	32509
15	2003-03-01	38651
16	2003-04-01	39789

17 2003-05-01 41194
18 2003-06-01 40813
19 2003-07-01 43413
20 2003-08-01 44267

	month	period	district	tot_pop	tot_white	tot_black	tot_hisp	p50_inc	crime_type	crimes
1	2005-01-01	1	1	38472	22608	4953	2543	91084.91	drug	1
2	2005-01-01	1	1	38472	22608	4953	2543	91084.91	drug	188
3	2005-01-01	1	1	38472	22608	4953	2543	91084.91	other	62
4	2005-01-01	1	1	38472	22608	4953	2543	91084.91	other	302
5	2005-01-01	1	1	38472	22608	4953	2543	91084.91	property	624
6	2005-01-01	1	1	38472	22608	4953	2543	91084.91	property	160
7	2005-01-01	1	1	38472	22608	4953	2543	91084.91	violent	150
8	2005-01-01	1	1	38472	22608	4953	2543	91084.91	violent	62
9	2005-01-01	1	2	37992	630	35966	628	29890.17	drug	1
10	2005-01-01	1	2	37992	630	35966	628	29890.17	drug	208
11	2005-01-01	1	2	37992	630	35966	628	29890.17	other	128
12	2005-01-01	1	2	37992	630	35966	628	29890.17	other	140
13	2005-01-01	1	2	37992	630	35966	628	29890.17	property	457
14	2005-01-01	1	2	37992	630	35966	628	29890.17	property	52
15	2005-01-01	1	2	37992	630	35966	628	29890.17	violent	290
16	2005-01-01	1	2	37992	630	35966	628	29890.17	violent	75
17	2005-01-01	1	3	78629	3217	71792	1371	28047.56	drug	259
18	2005-01-01	1	3	78629	3217	71792	1371	28047.56	other	148
19	2005-01-01	1	3	78629	3217	71792	1371	28047.56	other	161
20	2005-01-01	1	3	78629	3217	71792	1371	28047.56	property	548

	month	period	district	tot_pop	tot_white	tot_black	tot_hisp	p50_inc	crime_type.x	Total_crimes_per_resident	crime_type.y
1	2005-01-01	1	1	38472	22608	4953	2543	91084.91	drug	0.004912664	violent
2	2005-01-01	1	1	38472	22608	4953	2543	91084.91	other	0.009461426	violent
3	2005-01-01	1	1	38472	22608	4953	2543	91084.91	property	0.020378457	violent
4	2005-01-01	1	1	38472	22608	4953	2543	91084.91	violent	0.005510501	violent
5	2005-01-01	1	2	37992	630	35966	628	29890.17	drug	0.005501158	violent
6	2005-01-01	1	2	37992	630	35966	628	29890.17	other	0.007054117	violent
7	2005-01-01	1	2	37992	630	35966	628	29890.17	property	0.013397557	violent
8	2005-01-01	1	2	37992	630	35966	628	29890.17	violent	0.009607286	violent
9	2005-01-01	1	3	78629	3217	71792	1371	28047.56	drug	0.003293950	violent
10	2005-01-01	1	3	78629	3217	71792	1371	28047.56	other	0.003929848	violent
11	2005-01-01	1	3	78629	3217	71792	1371	28047.56	property	0.007707080	violent
12	2005-01-01	1	3	78629	3217	71792	1371	28047.56	violent	0.006778669	violent

13	2005-01-01	1	4	124519	9926	77314	35387	39010.22	drug	0.001823015	violent
14	2005-01-01	1	4	124519	9926	77314	35387	39010.22	other	0.002264715	violent
15	2005-01-01	1	4	124519	9926	77314	35387	39010.22	property	0.005734065	violent
16	2005-01-01	1	4	124519	9926	77314	35387	39010.22	violent	0.004947036	violent
17	2005-01-01	1	5	74384	843	70053	2524	33146.90	drug	0.003172725	violent
18	2005-01-01	1	5	74384	843	70053	2524	33146.90	other	0.003670144	violent
19	2005-01-01	1	5	74384	843	70053	2524	33146.90	property	0.006278232	violent
20	2005-01-01	1	5	74384	843	70053	2524	33146.90	violent	0.005848032	violent

	Violent_crimes_per_resident	crime_type	Property_crimes_per_resident
1	0.005510501	property	0.020378457
2	0.005510501	property	0.020378457
3	0.005510501	property	0.020378457
4	0.005510501	property	0.020378457
5	0.009607286	property	0.013397557
6	0.009607286	property	0.013397557
7	0.009607286	property	0.013397557
8	0.009607286	property	0.013397557
9	0.006778669	property	0.007707080
10	0.006778669	property	0.007707080
11	0.006778669	property	0.007707080
12	0.006778669	property	0.007707080
13	0.004947036	property	0.005734065
14	0.004947036	property	0.005734065
15	0.004947036	property	0.005734065
16	0.004947036	property	0.005734065
17	0.005848032	property	0.006278232
18	0.005848032	property	0.006278232
19	0.005848032	property	0.006278232
20	0.005848032	property	0.006278232

Exercise 3

Call:

lm(formula = md6$arrest ~ md6$tenure + md6$Total_crimes + md6$p50_inc +
    md6$tot_white + md6$tot_black + md6$tot_hisp - 1)

Residuals:

Min	1Q	Median	3Q	Max
-0.7225	-0.4789	-0.4213	0.5350	4.5764

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
md6$tenure	2.398e-04	3.847e-05	6.233	4.6e-10	***
md6$Total_crimes	1.923e-05	1.394e-05	1.379	0.168	
md6$p50_inc	5.710e-06	1.967e-07	29.034	< 2e-16	***
md6$tot_white	-4.833e-08	1.354e-07	-0.357	0.721	
md6$tot_black	4.059e-06	1.308e-07	31.026	< 2e-16	***

md6$tot_hisp   1.074e-06 7.750e-08 13.865 < 2e-16 ***

Residual standard error: 0.713 on 52993 degrees of freedom

  (2402 observations deleted due to missingness)

Multiple R-squared: 0.3275,Adjusted R-squared: 0.3275

F-statistic: 4302 on 6 and 52993 DF, p-value: < 2.2e-16

Exercise 4

Call:

lm(formula = md6$arrest ~ md6$tenure + md6$Total_crimes + md6$p50_inc +
    md6$tot_white + md6$tot_black + md6$tot_hisp + md6$district +
    factor(md6$month) - 1)

Residuals:

    Min   1Q Median   3Q   Max
-0.7210 -0.5104 -0.4495 0.4914 4.5301

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
md6$tenure	2.783e-05	3.931e-05	0.708	0.47887
md6$Total_crimes	-1.098e-05	1.425e-05	-0.770	0.44135
md6$p50_inc	-6.259e-07	3.056e-07	-2.048	0.04055 *
md6$tot_white	3.465e-07	1.394e-07	2.486	0.01294 *
md6$tot_black	6.417e-07	1.963e-07	3.269	0.00108 **
md6$tot_hisp	1.176e-07	8.543e-08	1.377	0.16860
md6$district	-6.978e-05	5.495e-04	-0.127	0.89896
factor(md6$month)2007-01-01	5.269e-01	3.572e-02	14.752	< 2e-16 ***
factor(md6$month)2007-02-01	5.436e-01	3.576e-02	15.203	< 2e-16 ***
factor(md6$month)2007-03-01	5.467e-01	3.558e-02	15.368	< 2e-16 ***
factor(md6$month)2007-04-01	4.520e-01	3.557e-02	12.706	< 2e-16 ***
factor(md6$month)2007-05-01	6.089e-01	3.539e-02	17.204	< 2e-16 ***
factor(md6$month)2007-06-01	4.330e-01	3.541e-02	12.227	< 2e-16 ***
factor(md6$month)2007-07-01	5.200e-01	3.546e-02	14.662	< 2e-16 ***
factor(md6$month)2007-08-01	5.705e-01	3.553e-02	16.054	< 2e-16 ***
factor(md6$month)2007-09-01	5.470e-01	3.560e-02	15.365	< 2e-16 ***
factor(md6$month)2007-10-01	4.667e-01	3.549e-02	13.153	< 2e-16 ***
factor(md6$month)2007-11-01	4.634e-01	3.518e-02	13.172	< 2e-16 ***
factor(md6$month)2007-12-01	5.052e-01	3.506e-02	14.410	< 2e-16 ***
factor(md6$month)2008-01-01	4.761e-01	3.531e-02	13.484	< 2e-16 ***
factor(md6$month)2008-02-01	5.388e-01	3.531e-02	15.258	< 2e-16 ***
factor(md6$month)2008-03-01	4.792e-01	3.522e-02	13.606	< 2e-16 ***
factor(md6$month)2008-04-01	5.117e-01	3.492e-02	14.653	< 2e-16 ***
factor(md6$month)2008-05-01	4.699e-01	3.504e-02	13.412	< 2e-16 ***
factor(md6$month)2008-06-01	5.558e-01	3.482e-02	15.961	< 2e-16 ***
factor(md6$month)2008-07-01	5.420e-01	3.458e-02	15.675	< 2e-16 ***
factor(md6$month)2008-08-01	5.206e-01	3.470e-02	15.005	< 2e-16 ***
factor(md6$month)2008-09-01	4.770e-01	3.453e-02	13.814	< 2e-16 ***
factor(md6$month)2008-10-01	5.134e-01	3.433e-02	14.955	< 2e-16 ***
factor(md6$month)2008-11-01	4.760e-01	3.441e-02	13.831	< 2e-16 ***
factor(md6$month)2008-12-01	4.787e-01	3.444e-02	13.897	< 2e-16 ***
factor(md6$month)2009-01-01	5.251e-01	3.452e-02	15.212	< 2e-16 ***
factor(md6$month)2009-02-01	5.314e-01	3.466e-02	15.333	< 2e-16 ***
factor(md6$month)2009-03-01	4.938e-01	3.455e-02	14.295	< 2e-16 ***

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factor(md6$month)2009-04-01  4.556e-01  3.481e-02  13.089  < 2e-16 ***
factor(md6$month)2009-05-01  4.201e-01  3.494e-02  12.024  < 2e-16 ***
factor(md6$month)2009-06-01  4.391e-01  3.497e-02  12.556  < 2e-16 ***
factor(md6$month)2009-07-01  4.274e-01  3.482e-02  12.273  < 2e-16 ***
factor(md6$month)2009-08-01  4.717e-01  3.483e-02  13.542  < 2e-16 ***
factor(md6$month)2009-09-01  4.297e-01  3.486e-02  12.326  < 2e-16 ***
factor(md6$month)2009-10-01  4.234e-01  3.487e-02  12.144  < 2e-16 ***
factor(md6$month)2009-11-01  5.256e-01  3.497e-02  15.029  < 2e-16 ***
factor(md6$month)2009-12-01  5.281e-01  3.489e-02  15.136  < 2e-16 ***
factor(md6$month)2010-01-01  4.834e-01  3.489e-02  13.852  < 2e-16 ***
factor(md6$month)2010-02-01  4.269e-01  3.507e-02  12.175  < 2e-16 ***
factor(md6$month)2010-03-01  5.454e-01  3.511e-02  15.534  < 2e-16 ***
factor(md6$month)2010-04-01  4.636e-01  3.519e-02  13.174  < 2e-16 ***
factor(md6$month)2010-05-01  4.633e-01  3.534e-02  13.108  < 2e-16 ***
factor(md6$month)2010-06-01  5.498e-01  3.534e-02  15.557  < 2e-16 ***
factor(md6$month)2010-07-01  5.401e-01  3.542e-02  15.249  < 2e-16 ***
factor(md6$month)2010-08-01  6.811e-01  3.543e-02  19.223  < 2e-16 ***
factor(md6$month)2010-09-01  5.063e-01  3.542e-02  14.295  < 2e-16 ***
factor(md6$month)2010-10-01  4.365e-01  3.534e-02  12.349  < 2e-16 ***
factor(md6$month)2010-11-01  4.861e-01  3.558e-02  13.662  < 2e-16 ***
factor(md6$month)2010-12-01  4.245e-01  3.557e-02  11.934  < 2e-16 ***
factor(md6$month)2011-01-01  5.520e-01  3.586e-02  15.391  < 2e-16 ***
factor(md6$month)2011-02-01  4.600e-01  3.638e-02  12.643  < 2e-16 ***
factor(md6$month)2011-03-01  4.389e-01  3.640e-02  12.057  < 2e-16 ***
factor(md6$month)2011-04-01  3.665e-01  3.641e-02  10.065  < 2e-16 ***
factor(md6$month)2011-05-01  4.569e-01  3.652e-02  12.509  < 2e-16 ***
factor(md6$month)2011-06-01  5.505e-01  3.634e-02  15.148  < 2e-16 ***
factor(md6$month)2011-07-01  5.650e-01  3.635e-02  15.541  < 2e-16 ***
factor(md6$month)2011-08-01  4.386e-01  3.640e-02  12.050  < 2e-16 ***
factor(md6$month)2011-09-01  4.488e-01  3.542e-02  12.672  < 2e-16 ***
factor(md6$month)2011-10-01  5.355e-01  3.542e-02  15.117  < 2e-16 ***
factor(md6$month)2011-11-01  5.751e-01  3.543e-02  16.231  < 2e-16 ***
factor(md6$month)2011-12-01  4.919e-01  3.550e-02  13.857  < 2e-16 ***
factor(md6$month)2012-01-01  4.783e-01  3.550e-02  13.475  < 2e-16 ***
factor(md6$month)2012-02-01  5.761e-01  3.520e-02  16.365  < 2e-16 ***
factor(md6$month)2012-03-01  5.708e-01  3.512e-02  16.251  < 2e-16 ***
factor(md6$month)2012-04-01  5.085e-01  3.529e-02  14.409  < 2e-16 ***
factor(md6$month)2012-05-01  4.370e-01  3.532e-02  12.373  < 2e-16 ***
factor(md6$month)2012-06-01  5.220e-01  3.533e-02  14.775  < 2e-16 ***
factor(md6$month)2012-07-01  4.894e-01  3.534e-02  13.848  < 2e-16 ***
factor(md6$month)2012-08-01  5.283e-01  3.533e-02  14.955  < 2e-16 ***
factor(md6$month)2012-09-01  5.049e-01  3.540e-02  14.264  < 2e-16 ***
factor(md6$month)2012-10-01  4.427e-01  3.534e-02  12.524  < 2e-16 ***
factor(md6$month)2012-11-01  4.978e-01  3.526e-02  14.117  < 2e-16 ***
factor(md6$month)2012-12-01  3.808e-01  3.526e-02  10.799  < 2e-16 ***
factor(md6$month)2013-01-01  4.315e-01  3.533e-02  12.213  < 2e-16 ***
factor(md6$month)2013-02-01  4.732e-01  3.540e-02  13.366  < 2e-16 ***
factor(md6$month)2013-03-01  3.783e-01  3.549e-02  10.661  < 2e-16 ***
factor(md6$month)2013-04-01  6.331e-01  3.534e-02  17.915  < 2e-16 ***
factor(md6$month)2013-05-01  5.425e-01  3.536e-02  15.343  < 2e-16 ***
factor(md6$month)2013-06-01  4.518e-01  3.542e-02  12.755  < 2e-16 ***
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factor(md6$month)2013-07-01 4.942e-01 3.551e-02 13.919 < 2e-16 ***
factor(md6$month)2013-08-01 4.615e-01 3.552e-02 12.995 < 2e-16 ***
factor(md6$month)2013-09-01 5.105e-01 3.558e-02 14.350 < 2e-16 ***
factor(md6$month)2013-10-01 4.445e-01 3.557e-02 12.499 < 2e-16 ***
factor(md6$month)2013-11-01 4.837e-01 3.557e-02 13.601 < 2e-16 ***
factor(md6$month)2013-12-01 5.032e-01 3.555e-02 14.154 < 2e-16 ***
factor(md6$month)2014-01-01 4.568e-01 3.568e-02 12.806 < 2e-16 ***
factor(md6$month)2014-02-01 4.696e-01 3.569e-02 13.158 < 2e-16 ***
factor(md6$month)2014-03-01 4.766e-01 3.568e-02 13.358 < 2e-16 ***
factor(md6$month)2014-04-01 3.945e-01 6.301e-02   6.261 3.86e-10 ***

Signif. codes: 0 鈥?**鈥?0.001 鈥?*鈥?0.01 鈥?鈥?0.05 鈥?鈥?0.1 鈥?鈥?1
Residual standard error: 0.7066 on 52904 degrees of freedom
  (2402 observations deleted due to missingness)
Multiple R-squared: 0.3406,Adjusted R-squared: 0.3394
F-statistic: 287.7 on 95 and 52904 DF, p-value: < 2.2e-16
Exercise 5
Within

	Estimate	Std. Error	t value	Pr(>|t|)
Total_Crime	-4.121670e-02	5.918930e-05	-696.35391	0.000000e+00
p50_inc	-1.477408e-03	1.061685e-05	-139.15693	0.000000e+00
tot_black	-7.235609e+01	1.615373e+00	-44.79220	0.000000e+00
tot_hisp	-3.003595e+02	3.093401e+00	-97.09686	0.000000e+00
tot_white	8.868806e+01	2.812809e+00	31.53007	3.774371e-218

Between

	Estimate	Std. Error	t value	Pr(>|t|)
Total_Crime	-4.287996e-03	8.439758e-03	-0.50807092	6.114123e-01
p50_inc	6.642523e-04	1.037956e-03	0.63996187	5.222088e-01
tot_black	-1.098566e+02	1.695283e+02	-0.64801347	5.169878e-01
tot_hisp	-3.381840e+02	3.274060e+02	-1.03291923	3.016611e-01
tot_white	-1.687822e+02	2.985714e+02	-0.56529915	5.718802e-01

First Difference

	Estimate	Std. Error	t value	Pr(>|t|)
Total_Crime	-2.587856e-02	1.577121e-04	-164.0873627	0.000000e+00
p50_inc	4.109763e-04	1.035946e-05	39.6715967	0.000000e+00
tot_black	1.656223e+02	3.951592e-01	419.1281293	0.000000e+00
tot_hisp	1.810360e+02	4.826598e-01	375.0798315	0.000000e+00
tot_white	2.102690e+02	1.035240e+00	203.1113374	0.000000e+00

GMM

total_crime_district	median_income	share_of_black	share_of_hispanic	share_of_white
-218146.5	-9972097	-11.64609	-74.30712	-67.29415