

- a) Done in code
b)

Provided is the summary output of lasso along with the MSE:

$$MSE_{lasso} = 5.61$$

```
100 x 1 sparse Matrix of class "dgCMatrix"
s0
```

```
absences          .
G1                0.09270907
G2                0.93696038
sex_F             .
sex_M             .
age_15            .
age_16            .
age_17            .
age_18            .
address_R         .
address_U         .
famsize_GT3       .
famsize_LE3       .
Pstatus_A         .
Pstatus_T         .
Medu_0            .
Medu_1            .
Medu_2            .
Medu_3            .
Medu_4            .
Fedu_0            .
Fedu_1            .
Fedu_2            .
Fedu_3            .
Fedu_4            .
Mjob_at_home      -0.04700269
```

Mjob_health	.
Mjob_other	.
Mjob_services	.
Mjob_teacher	.
Fjob_at_home	.
Fjob_health	.
Fjob_other	.
Fjob_services	.
Fjob_teacher	.
reason_course	.
reason_home	.
reason_other	.
reason_reputation	.
guardian_father	.
guardian_mother	.
guardian_other	.
traveltime_1	.
traveltime_2	.
traveltime_3	.
traveltime_4	.
studytime_1	.
studytime_2	.
studytime_3	.
studytime_4	.
failures_0	.
failures_1	.
failures_2	.
failures_3	.
schoolsup_no	.
schoolsup_yes	.
famsup_no	.
famsup_yes	.
paid_no	.
paid_yes	.
activities_no	.
activities_yes	.
nursery_no	.
nursery_yes	.
higher_no	.

higher_yes	.
internet_no	.
internet_yes	.
romantic_no	.
romantic_yes	.
famrel_1	.
famrel_2	.
famrel_3	.
famrel_4	.
famrel_5	.
freetime_1	.
freetime_2	.
freetime_3	.
freetime_4	.
freetime_5	.
goout_1	.
goout_2	.
goout_3	.
goout_4	.
goout_5	.
Dalc_1	.
Dalc_2	.
Dalc_3	.
Dalc_4	.
Dalc_5	.
Walc_1	.
Walc_2	.
Walc_3	.
Walc_4	.
Walc_5	.
health_1	.
health_2	.
health_3	.
health_4	.
health_5	.

As seen from the output, lasso seemed to have set all coefficients to 0 except for G1, G2 and $M_{\text{jobathome}}$

c)

Provides is the output from the glasso model:

```
grLasso-penalized linear regression with n=277, p=95
At minimum cross-validation error (lambda=0.1763):
-----
Nonzero coefficients: 12
Nonzero groups: 6
Cross-validation error of 3.59
Maximum R-squared: 0.83
Maximum signal-to-noise ratio: 4.84
Scale estimate (sigma) at lambda.min: 1.894
      4.1692      3.7988      3.4613      3.1538
2.8737  2.6184  2.3858  2.1738  1.9807
(Intercept)      10.68592  9.62871432  8.6654273  7.7877161
6.9879784  6.259287  5.5953308  4.9903585  4.4391302
absences          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
G1              0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
G2              0.00000  0.09664889  0.1847118  0.2649514
0.3380627  0.404679  0.4653774  0.5206834  0.5710762
sex_F           0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
sex_M           0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_15          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_16          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_17          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_18          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
      1.8047      1.6444      1.4983      1.3652
1.2439  1.1334  1.0327  0.941  0.8574
(Intercept)      3.9368716  3.4792323  3.0622483  2.6823081
2.3361207  2.0206877  1.733277  1.4713987  1.225231827
```

```

absences          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
G1                0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.002666296
G2                0.6169923 0.6588293 0.6969496 0.7316834
0.7633315 0.7921682 0.818443 0.8423837 0.862185673
sex_F             0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
sex_M             0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
age_15            0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
age_16            0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
age_17            0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
age_18            0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.0000000 0.0000000 0.0000000000
                0.7812      0.7118      0.6486      0.591
0.5385      0.4906      0.447      0.4073
(Intercept)      0.97121127 0.74133565 0.53220045 0.34165390
0.16803527 0.009574209 -0.1345541 -0.2658682
absences          0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
G1                0.01558756 0.02680375 0.03691095 0.04611685
0.05450482 0.062241609 0.0692009 0.0755383
G2                0.87231191 0.88195898 0.89083397 0.89892311
0.90629370 0.912938601 0.9190612 0.9246427
sex_F             0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
sex_M             0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
age_15            0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
age_16            0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
age_17            0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000

```

age_18	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
	0.3711	0.3382	0.3081	0.2808
0.2558	0.2331	0.2124		
(Intercept)	-0.38578898	-0.49479836	-0.59410967	-0.68487823
-0.76732292	-0.860888639	-0.95238519		
absences	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.002808517	0.00592549		
G1	0.08140883	0.08666677	0.09145268	0.09591219
0.09988366	0.103304927	0.10647924		
G2	0.92965579	0.93429224	0.93852053	0.94229866
0.94581047	0.949352387	0.95199842		
sex_F	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
sex_M	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_15	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_16	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_17	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_18	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
	0.1935	0.1763	0.1607	
0.1464	0.1334	0.1215	0.1107	
(Intercept)	-1.043308544	-1.125362255	-1.20127472	
-1.2728054376	-1.355947097	-1.434215018	-1.451387264	
absences	0.008916840	0.011690222	0.01412814	
0.0165976002	0.018757132	0.020778422	0.022904450	
G1	0.110513031	0.113080107	0.11620463	
0.1180482969	0.120453221	0.124926252	0.131325739	
G2	0.953536325	0.955828590	0.95742930	
0.9591428657	0.959670764	0.958204799	0.954732185	
sex_F	0.000000000	0.000000000	0.000000000	
-0.0039224017	-0.012979586	-0.021106123	-0.032225093	
sex_M	0.000000000	0.000000000	0.000000000	
0.0039224017	0.012979586	0.021106123	0.032225093	

age_15		0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.003193273	0.008947843	
age_16		0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.005218413	0.016905998	
age_17		0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.004978185	0.016362209	
age_18		0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	-0.015554504	-0.049186027	
		0.1009	0.0919	0.0838
0.0763	0.0695	0.0634		
(Intercept)		-1.465915118	-1.485238415	-1.5102215797
-1.538108878	-1.557016189	-1.5723685854		
absences		0.024704936	0.026281286	0.0277263225
0.029078747	0.030333702	0.0314869544		
G1		0.138004743	0.144630000	0.1513321514
0.157929767	0.163718462	0.1683020351		
G2		0.951129210	0.947724174	0.9445021736
0.941526841	0.938702782	0.9365736220		
sex_F		-0.040711293	-0.046800384	-0.0521895157
-0.058137528	-0.062295766	-0.0665621903		
sex_M		0.040711293	0.046800384	0.0521895157
0.058137528	0.062295766	0.0665621903		
age_15		0.012918104	0.015268282	0.0159228410
0.015666535	0.014094250	0.0117587585		
age_16		0.027874111	0.038106728	0.0478086599
0.057368057	0.067025530	0.0763478172		
age_17		0.026702930	0.035815583	0.0442319671
0.052112829	0.059158798	0.0658699017		
age_18		-0.078869769	-0.104553122	-0.1270077443
-0.147732679	-0.166281723	-0.1832299831		
		0.0577	0.0526	0.0479
0.0437	0.0398	0.0363		
(Intercept)		-1.5786477621	-1.578006e+00	-1.5777672629
-1.577983467	-1.576189302	-1.571554353		
absences		0.0325564744	3.351887e-02	0.0343679097
0.035120043	0.035838486	0.036495129		
G1		0.1737091544	1.789371e-01	0.1837822945
0.188232461	0.192472771	0.195936938		

G2	0.9333480655	9.298432e-01	0.9265514320
0.923500438	0.920627853	0.918244569	
sex_F	-0.0696003197	-7.149288e-02	-0.0732555610
-0.074926235	-0.076608587	-0.077864037	
sex_M	0.0696003197	7.149288e-02	0.0732555610
0.074926235	0.076608587	0.077864037	
age_15	0.0083123236	3.880150e-03	-0.0010951663
-0.006455239	-0.011894702	-0.017426135	
age_16	0.0852800424	9.385328e-02	0.1021182113
0.110041032	0.117541579	0.124978104	
age_17	0.0727929357	7.938991e-02	0.0854615189
0.091038844	0.095885610	0.099932493	
age_18	-0.1987466218	-2.124084e-01	-0.2245240326
-0.235250567	-0.244543945	-0.252774801	
	0.033	0.0301	0.0274
0.025	0.0228	0.0208	0.0189
(Intercept)	-1.573415450	-1.5761154366	-1.578978118
-1.582190384	-1.584815733	-1.587424939	-1.588480206
absences	0.037147337	0.0377352654	0.038268777
0.038752248	0.039202863	0.039619290	0.039987564
G1	0.198522491	0.2011658861	0.203521079
0.205782948	0.208177626	0.210339886	0.212105113
G2	0.916603537	0.9148839389	0.913348824
0.911862188	0.910268415	0.908835394	0.907525662
sex_F	-0.079055372	-0.0801891876	-0.081290141
-0.082340351	-0.083524437	-0.084705061	-0.085757684
sex_M	0.079055372	0.0801891876	0.081290141
0.082340351	0.083524437	0.084705061	0.085757684
age_15	-0.021985289	-0.0265671034	-0.031062814
-0.035447002	-0.039475402	-0.043076899	-0.046367265
age_16	0.132255089	0.1391489686	0.145632586
0.151759958	0.157589374	0.162973718	0.167843936
age_17	0.103140090	0.1060464517	0.108624195
0.110918170	0.113123324	0.115229310	0.117446855
age_18	-0.260892390	-0.2681610119	-0.274629517
-0.280443529	-0.286149406	-0.291621191	-0.296881627
	0.0172	0.0157	0.0143
0.013	0.0119	0.0108	0.0099

(Intercept)	-1.5901983115	-1.591934244	-1.593638703
	-1.595299477	-1.596866529	-1.598459276
absences	0.0403209903	0.040625161	0.040901565
	0.041153268	0.041382721	0.041593782
G1	0.2139226030	0.215531229	0.217129181
	0.218645237	0.220068601	0.221288179
G2	0.9061897485	0.904996970	0.903797314
	0.902649700	0.901563560	0.900631257
sex_F	-0.0868258158	-0.087889070	-0.088913664
	-0.089909010	-0.090871305	-0.091811412
sex_M	0.0868258158	0.087889070	0.088913664
	0.089909010	0.090871305	0.091811412
age_15	-0.0495237080	-0.052503562	-0.055338651
	-0.058018808	-0.060546945	-0.062888576
age_16	0.1723913849	0.176541317	0.180404596
	0.183962638	0.187233735	0.190182603
age_17	0.1194754941	0.121354655	0.123129480
	0.124795971	0.126357794	0.127776840
age_18	-0.3016588931	-0.305945211	-0.309899584
	-0.313504367	-0.316784068	-0.319687380
		0.009	0.0082
			0.0075
	0.0068	0.0062	0.0056
			0.0051
(Intercept)	-1.600981863	-1.602342810	-1.603279526
	-1.605244244	-1.606552832	-1.6078158677
absences	0.041959290	0.042120545	0.042272694
	0.042429942	0.042565936	0.0426898942
G1	0.223667941	0.224639003	0.225832582
	0.226742134	0.227657674	0.2285402966
G2	0.898783789	0.898033652	0.897075007
	0.896385034	0.895665887	0.8949721714
sex_F	-0.093532688	-0.094327297	-0.095066755
	-0.095697831	-0.096314422	-0.0968841033
sex_M	0.093532688	0.094327297	0.095066755
	0.095697831	0.096314422	0.0968841033
age_15	-0.067211179	-0.069112458	-0.071108966
	-0.073062192	-0.074856050	-0.0765307791
age_16	0.195472835	0.197741321	0.200024046
	0.202104806	0.204023870	0.2058021750
			0.207232292

age_17	0.130397403	0.131511925	0.132603727
0.133363647	0.134164538	0.1349096015	0.135602639
age_18	-0.324850936	-0.327004927	-0.329052290
-0.330518746	-0.331989715	-0.3333429673	-0.334421111
	0.0047	0.0043	0.0039
0.0035	0.0032	0.0029	0.0027
(Intercept)	-1.611684153	-1.613194771	-1.614846999
-1.615865271	-1.617455439	-1.618365358	-1.619181261
absences	0.042899833	0.042989449	0.043073633
0.043146148	0.043216562	0.043279113	0.043334547
G1	0.229964550	0.230662728	0.231206671
0.231873806	0.232262683	0.232782885	0.233282013
G2	0.893828437	0.893264667	0.892833106
0.892286039	0.891991003	0.891557454	0.891150518
sex_F	-0.097741139	-0.098128413	-0.098474663
-0.098822572	-0.099099749	-0.099404079	-0.099662482
sex_M	0.097741139	0.098128413	0.098474663
0.098822572	0.099099749	0.099404079	0.099662482
age_15	-0.079412178	-0.080746255	-0.081876393
-0.083096909	-0.083946848	-0.084984195	-0.085901268
age_16	0.208601199	0.209872563	0.210968802
0.212091547	0.212941170	0.213880051	0.214721961
age_17	0.136285086	0.136924447	0.137463365
0.138034444	0.138484086	0.138904972	0.139340472
age_18	-0.335439782	-0.336381799	-0.337201533
-0.337996134	-0.338693979	-0.339278322	-0.339880260
	0.0024	0.0022	0.002
0.0018	0.0017	0.0015	0.0014
(Intercept)	-1.620233061	-1.621089667	-1.621775028
-1.62236109	-1.623091524	-1.623512104	-1.624044207
absences	0.043386561	0.043434352	0.043477144
0.04351580	0.043549671	0.043584367	0.043611825
G1	0.233642175	0.233996333	0.234346337
0.23468467	0.234918180	0.235232397	0.235453135
G2	0.890869410	0.890582992	0.890297389
0.89002111	0.889848187	0.889576252	0.889409174
sex_F	-0.099887027	-0.100108140	-0.100313489
-0.10049932	-0.100664512	-0.100823130	-0.100965409

sex_M		0.099887027	0.100108140	0.100313489
	0.10049932	0.100664512	0.100823130	0.100965409
age_15		-0.086620998	-0.087343016	-0.088030589
	-0.08867217	-0.089142451	-0.089756360	-0.090174551
age_16		0.215414207	0.216084146	0.216711745
	0.21729499	0.217771892	0.218288356	0.218701559
age_17		0.139706296	0.140023662	0.140333077
	0.14062438	0.140889042	0.141103155	0.141338457
age_18		-0.340419720	-0.340874567	-0.341302320
	-0.34170127	-0.342113662	-0.342370496	-0.342723186
		0.0013	0.0012	0.0011
0.001	9e-04	8e-04		
(Intercept)		-1.624534826	-1.62493607	-1.625261701
	-1.625533872	-1.625770e+00	-1.6259765868	
absences		0.043639479	0.04366435	0.043686664
	0.043706786	4.372500e-02	0.0437344609	
G1		0.235660009	0.23586408	0.236063739
	0.236256473	2.364403e-01	0.2365397228	
G2		0.889241599	0.88907437	0.888910026
	0.888751240	8.886000e-01	0.8885309375	
sex_F		-0.101090354	-0.10121037	-0.101321626
	-0.101422529	-1.015137e-01	-0.1015903754	
sex_M		0.101090354	0.10121037	0.101321626
	0.101422529	1.015137e-01	0.1015903754	
age_15		-0.090594162	-0.09099901	-0.091381010
	-0.091737366	-9.206713e-02	-0.0922217936	
age_16		0.219086585	0.21945186	0.219792819
	0.220109589	2.204027e-01	0.2206077546	
age_17		0.141522959	0.14169426	0.141859281
	0.142015490	1.421611e-01	0.1422714758	
age_18		-0.342982044	-0.34321641	-0.343436528
	-0.343642706	-3.438346e-01	-0.3440580140	
		7e-04	7e-04	6e-04
6e-04	5e-04	5e-04		
(Intercept)		-1.626115e+00	-1.6262019369	-1.6264365831
	-1.6266462867	-1.6268139388	-1.6269409839	
absences		4.375783e-02	0.0437642322	0.0437766577
	0.0437892189	0.0438008204	0.0438112215	

```

G1                2.367804e-01  0.2368705894  0.2369532174
0.2370301711  0.2371057360  0.2371812644
G2                8.883143e-01  0.8882540213  0.8881937253
0.8881321708  0.8880694049  0.8880057075
sex_F            -1.016739e-01 -0.1017385552 -0.1017935232
-0.1018417302 -0.1018881984 -0.1019334636
sex_M             1.016739e-01  0.1017385552  0.1017935232
0.1018417302  0.1018881984  0.1019334636
age_15           -9.267819e-02 -0.0928020715 -0.0929682024
-0.0931377281 -0.0933068785 -0.0934715336
age_16            2.209295e-01  0.2211067168  0.2212750054
0.2214323144  0.2215853031  0.2217314912
age_17            1.424031e-01  0.1425079195  0.1426083965
0.1426850571  0.1427486824  0.1428080720
age_18           -3.441386e-01 -0.3443522821 -0.3445054475
-0.3446146275 -0.3447042450 -0.3447851542
                                4e-04
(Intercept)      -1.6270318659
absences          0.0438204968
G1                0.2372566843
G2                0.8879416131
sex_F            -0.1019766322
sex_M             0.1019766322
age_15           -0.0936294082
age_16            0.2218694582
age_17            0.1428663347
age_18           -0.3448613600
[ reached getOption("max.print") -- omitted 86 rows ]

```

$$MSE_{glasso} = 5.85$$

We can see from the output that there's 5 non-zero groups without the intercept corresponding to absences, G1, G2, sex, age and the intercept.

d)

Now we will try and create a different grouping and determine the results:

In our case we will create two new variables called

AlcoholConsumption = *Walc* + *Dalc*
PrimaryEducation = *Medc* + *Fedc*

Then we will create dummy variables from the result of these newly derived variables. Upon completion, then we will regenerate the *group_factor*, which will group all of the variables together based on the prefix.

From this we can see the following results from the newly created grouped variables:

```
grLasso-penalized linear regression with n=277, p=99
At minimum cross-validation error (lambda=0.2179):
-----
Nonzero coefficients: 5
Nonzero groups: 3
Cross-validation error of 3.62
Maximum R-squared: 0.81
Maximum signal-to-noise ratio: 4.18
Scale estimate (sigma) at lambda.min: 1.903
      4.1692      3.7988      3.4613      3.1538
2.8737  2.6184  2.3858  2.1738  1.9807
(Intercept)      10.68592  9.62871432  8.6654273  7.7877161
6.9879784  6.259287  5.5953308  4.9903585  4.4391302
absences      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
G1      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
G2      0.00000  0.09664889  0.1847118  0.2649514
0.3380627  0.404679  0.4653774  0.5206834  0.5710762
sex_F      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
sex_M      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_15      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_16      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
age_17      0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000  0.0000000
```

```

age_18          0.00000 0.00000000 0.0000000 0.0000000
0.0000000 0.000000 0.0000000 0.0000000 0.0000000
          1.8047    1.6444    1.4983    1.3652
1.2439    1.1334    1.0327    0.941    0.8574
(Intercept)    3.9368716 3.4792323 3.0622483 2.6823081
2.3361207 2.0206877 1.733277 1.4713987 1.225231827
absences          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
G1          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.002666296
G2          0.6169923 0.6588293 0.6969496 0.7316834
0.7633315 0.7921682 0.818443 0.8423837 0.862185673
sex_F          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
sex_M          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
age_15          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
age_16          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
age_17          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
age_18          0.0000000 0.0000000 0.0000000 0.0000000
0.0000000 0.0000000 0.000000 0.0000000 0.0000000000
          0.7812    0.7118    0.6486    0.591
0.5385    0.4906    0.447    0.4073
(Intercept)    0.97121127 0.74133565 0.53220045 0.34165390
0.16803527 0.009574209 -0.1345541 -0.2658682
absences          0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
G1          0.01558756 0.02680375 0.03691095 0.04611685
0.05450482 0.062241609 0.0692009 0.0755383
G2          0.87231191 0.88195898 0.89083397 0.89892311
0.90629370 0.912938601 0.9190612 0.9246427
sex_F          0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000
sex_M          0.00000000 0.00000000 0.00000000 0.00000000
0.00000000 0.000000000 0.0000000 0.00000000

```

age_15	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
age_16	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
age_17	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
age_18	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
	0.3711	0.3382	0.3081	0.2808
0.2558	0.2331	0.2124		
(Intercept)	-0.38578898	-0.49479836	-0.59410967	-0.68487823
-0.76732292	-0.860888639	-0.95238519		
absences	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.002808517	0.00592549		
G1	0.08140883	0.08666677	0.09145268	0.09591219
0.09988366	0.103304927	0.10647924		
G2	0.92965579	0.93429224	0.93852053	0.94229866
0.94581047	0.949352387	0.95199842		
sex_F	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
sex_M	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_15	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_16	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_17	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
age_18	0.00000000	0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000		
	0.1935	0.1763	0.1607	
0.1464	0.1334	0.1215	0.1107	
(Intercept)	-1.043308544	-1.125362255	-1.20127472	
-1.2728054376	-1.355947097	-1.434215018	-1.451387264	
absences	0.008916840	0.011690222	0.01412814	
0.0165976002	0.018757132	0.020778422	0.022904450	
G1	0.110513031	0.113080107	0.11620463	
0.1180482969	0.120453221	0.124926252	0.131325739	

G2	0.953536325	0.955828590	0.95742930
0.9591428657	0.959670764	0.958204799	0.954732185
sex_F	0.000000000	0.000000000	0.000000000
-0.0039224017	-0.012979586	-0.021106123	-0.032225093
sex_M	0.000000000	0.000000000	0.000000000
0.0039224017	0.012979586	0.021106123	0.032225093
age_15	0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.003193273	0.008947843
age_16	0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.005218413	0.016905998
age_17	0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	0.004978185	0.016362209
age_18	0.000000000	0.000000000	0.000000000
0.0000000000	0.000000000	-0.015554504	-0.049186027
	0.1009	0.0919	0.0838
0.0763	0.0695	0.0634	
(Intercept)	-1.465915118	-1.485238415	-1.5102215797
-1.538108878	-1.557016189	-1.5723685854	
absences	0.024704936	0.026281286	0.0277263225
0.029078747	0.030333702	0.0314869544	
G1	0.138004743	0.144630000	0.1513321514
0.157929767	0.163718462	0.1683020351	
G2	0.951129210	0.947724174	0.9445021736
0.941526841	0.938702782	0.9365736220	
sex_F	-0.040711293	-0.046800384	-0.0521895157
-0.058137528	-0.062295766	-0.0665621903	
sex_M	0.040711293	0.046800384	0.0521895157
0.058137528	0.062295766	0.0665621903	
age_15	0.012918104	0.015268282	0.0159228410
0.015666535	0.014094250	0.0117587585	
age_16	0.027874111	0.038106728	0.0478086599
0.057368057	0.067025530	0.0763478172	
age_17	0.026702930	0.035815583	0.0442319671
0.052112829	0.059158798	0.0658699017	
age_18	-0.078869769	-0.104553122	-0.1270077443
-0.147732679	-0.166281723	-0.1832299831	
	0.0577	0.0526	0.0479
0.0437	0.0398	0.0363	


```

(Intercept)      -1.5786477621 -1.578006e+00 -1.5777672629
-1.577983467 -1.576189302 -1.571554353
absences          0.0325564744  3.351887e-02  0.0343679097
0.035120043  0.035838486  0.036495129
G1                0.1737091544  1.789371e-01  0.1837822945
0.188232461  0.192472771  0.195936938
G2                0.9333480655  9.298432e-01  0.9265514320
0.923500438  0.920627853  0.918244569
sex_F             -0.0696003197 -7.149288e-02 -0.0732555610
-0.074926235 -0.076608587 -0.077864037
sex_M             0.0696003197  7.149288e-02  0.0732555610
0.074926235  0.076608587  0.077864037
age_15            0.0083123236  3.880150e-03 -0.0010951663
-0.006455239 -0.011894702 -0.017426135
age_16            0.0852800424  9.385328e-02  0.1021182113
0.110041032  0.117541579  0.124978104
age_17            0.0727929357  7.938991e-02  0.0854615189
0.091038844  0.095885610  0.099932493
age_18            -0.1987466218 -2.124084e-01 -0.2245240326
-0.235250567 -0.244543945 -0.252774801
0.025           0.0228           0.033           0.0301           0.0274
0.025           0.0228           0.0208           0.0189
(Intercept)      -1.573415450 -1.5761154366 -1.578978118
-1.582190384 -1.584815733 -1.587424939 -1.588480206
absences          0.037147337  0.0377352654  0.038268777
0.038752248  0.039202863  0.039619290  0.039987564
G1                0.198522491  0.2011658861  0.203521079
0.205782948  0.208177626  0.210339886  0.212105113
G2                0.916603537  0.9148839389  0.913348824
0.911862188  0.910268415  0.908835394  0.907525662
sex_F             -0.079055372 -0.0801891876 -0.081290141
-0.082340351 -0.083524437 -0.084705061 -0.085757684
sex_M             0.079055372  0.0801891876  0.081290141
0.082340351  0.083524437  0.084705061  0.085757684
age_15            -0.021985289 -0.0265671034 -0.031062814
-0.035447002 -0.039475402 -0.043076899 -0.046367265
age_16            0.132255089  0.1391489686  0.145632586
0.151759958  0.157589374  0.162973718  0.167843936

```

age_17	0.103140090	0.1060464517	0.108624195
0.110918170	0.113123324	0.115229310	0.117446855
age_18	-0.260892390	-0.2681610119	-0.274629517
-0.280443529	-0.286149406	-0.291621191	-0.296881627
	0.0172	0.0157	0.0143
0.013	0.0119	0.0108	0.0099
(Intercept)	-1.5901983115	-1.591934244	-1.593638703
-1.595299477	-1.596866529	-1.598459276	-1.59976448
absences	0.0403209903	0.040625161	0.040901565
0.041153268	0.041382721	0.041593782	0.04178504
G1	0.2139226030	0.215531229	0.217129181
0.218645237	0.220068601	0.221288179	0.22250737
G2	0.9061897485	0.904996970	0.903797314
0.902649700	0.901563560	0.900631257	0.89968630
sex_F	-0.0868258158	-0.087889070	-0.088913664
-0.089909010	-0.090871305	-0.091811412	-0.09269533
sex_M	0.0868258158	0.087889070	0.088913664
0.089909010	0.090871305	0.091811412	0.09269533
age_15	-0.0495237080	-0.052503562	-0.055338651
-0.058018808	-0.060546945	-0.062888576	-0.06511964
age_16	0.1723913849	0.176541317	0.180404596
0.183962638	0.187233735	0.190182603	0.19293721
age_17	0.1194754941	0.121354655	0.123129480
0.124795971	0.126357794	0.127776840	0.12913257
age_18	-0.3016588931	-0.305945211	-0.309899584
-0.313504367	-0.316784068	-0.319687380	-0.32238697
	0.009	0.0082	0.0075
0.0068	0.0062	0.0056	0.0051
(Intercept)	-1.600981863	-1.602342810	-1.603279526
-1.605244244	-1.606552832	-1.6078158677	-1.609984511
absences	0.041959290	0.042120545	0.042272694
0.042429942	0.042565936	0.0426898942	0.042801015
G1	0.223667941	0.224639003	0.225832582
0.226742134	0.227657674	0.2285402966	0.229245471
G2	0.898783789	0.898033652	0.897075007
0.896385034	0.895665887	0.8949721714	0.894409272
sex_F	-0.093532688	-0.094327297	-0.095066755
-0.095697831	-0.096314422	-0.0968841033	-0.097316930

sex_M	0.093532688	0.094327297	0.095066755
0.095697831	0.096314422	0.0968841033	0.097316930
age_15	-0.067211179	-0.069112458	-0.071108966
-0.073062192	-0.074856050	-0.0765307791	-0.077986216
age_16	0.195472835	0.197741321	0.200024046
0.202104806	0.204023870	0.2058021750	0.207232292
age_17	0.130397403	0.131511925	0.132603727
0.133363647	0.134164538	0.1349096015	0.135602639
age_18	-0.324850936	-0.327004927	-0.329052290
-0.330518746	-0.331989715	-0.3333429673	-0.334421111
	0.0047	0.0043	0.0039
0.0035	0.0032	0.0029	0.0027
(Intercept)	-1.611684153	-1.613194771	-1.614846999
-1.615865271	-1.617455439	-1.618365358	-1.619181261
absences	0.042899833	0.042989449	0.043073633
0.043146148	0.043216562	0.043279113	0.043334547
G1	0.229964550	0.230662728	0.231206671
0.231873806	0.232262683	0.232782885	0.233282013
G2	0.893828437	0.893264667	0.892833106
0.892286039	0.891991003	0.891557454	0.891150518
sex_F	-0.097741139	-0.098128413	-0.098474663
-0.098822572	-0.099099749	-0.099404079	-0.099662482
sex_M	0.097741139	0.098128413	0.098474663
0.098822572	0.099099749	0.099404079	0.099662482
age_15	-0.079412178	-0.080746255	-0.081876393
-0.083096909	-0.083946848	-0.084984195	-0.085901268
age_16	0.208601199	0.209872563	0.210968802
0.212091547	0.212941170	0.213880051	0.214721961
age_17	0.136285086	0.136924447	0.137463365
0.138034444	0.138484086	0.138904972	0.139340472
age_18	-0.335439782	-0.336381799	-0.337201533
-0.337996134	-0.338693979	-0.339278322	-0.339880260
	0.0024	0.0022	0.002
0.0018	0.0017	0.0015	0.0014
(Intercept)	-1.620233061	-1.621089667	-1.621775028
-1.62236109	-1.623091524	-1.623512104	-1.624044207
absences	0.043386561	0.043434352	0.043477144
0.04351580	0.043549671	0.043584367	0.043611825

G1	0.233642175	0.233996333	0.234346337
0.23468467	0.234918180	0.235232397	0.235453135
G2	0.890869410	0.890582992	0.890297389
0.89002111	0.889848187	0.889576252	0.889409174
sex_F	-0.099887027	-0.100108140	-0.100313489
-0.10049932	-0.100664512	-0.100823130	-0.100965409
sex_M	0.099887027	0.100108140	0.100313489
0.10049932	0.100664512	0.100823130	0.100965409
age_15	-0.086620998	-0.087343016	-0.088030589
-0.08867217	-0.089142451	-0.089756360	-0.090174551
age_16	0.215414207	0.216084146	0.216711745
0.21729499	0.217771892	0.218288356	0.218701559
age_17	0.139706296	0.140023662	0.140333077
0.14062438	0.140889042	0.141103155	0.141338457
age_18	-0.340419720	-0.340874567	-0.341302320
-0.34170127	-0.342113662	-0.342370496	-0.342723186
	0.0013	0.0012	0.0011
0.001	9e-04	8e-04	
(Intercept)	-1.624534826	-1.62493607	-1.625261701
-1.625533872	-1.625770e+00	-1.6259765868	
absences	0.043639479	0.04366435	0.043686664
0.043706786	4.372500e-02	0.0437344609	
G1	0.235660009	0.23586408	0.236063739
0.236256473	2.364403e-01	0.2365397228	
G2	0.889241599	0.88907437	0.888910026
0.888751240	8.886000e-01	0.8885309375	
sex_F	-0.101090354	-0.10121037	-0.101321626
-0.101422529	-1.015137e-01	-0.1015903754	
sex_M	0.101090354	0.10121037	0.101321626
0.101422529	1.015137e-01	0.1015903754	
age_15	-0.090594162	-0.09099901	-0.091381010
-0.091737366	-9.206713e-02	-0.0922217936	
age_16	0.219086585	0.21945186	0.219792819
0.220109589	2.204027e-01	0.2206077546	
age_17	0.141522959	0.14169426	0.141859281
0.142015490	1.421611e-01	0.1422714758	
age_18	-0.342982044	-0.34321641	-0.343436528
-0.343642706	-3.438346e-01	-0.3440580140	

```

              7e-04              7e-04              6e-04
    6e-04      5e-04      5e-04
(Intercept)    -1.626115e+00 -1.6262019369 -1.6264365831
-1.6266462867 -1.6268139388 -1.6269409839
absences        4.375783e-02  0.0437642322  0.0437766577
0.0437892189  0.0438008204  0.0438112215
G1              2.367804e-01  0.2368705894  0.2369532174
0.2370301711  0.2371057360  0.2371812644
G2              8.883143e-01  0.8882540213  0.8881937253
0.8881321708  0.8880694049  0.8880057075
sex_F          -1.016739e-01 -0.1017385552 -0.1017935232
-0.1018417302 -0.1018881984 -0.1019334636
sex_M           1.016739e-01  0.1017385552  0.1017935232
0.1018417302  0.1018881984  0.1019334636
age_15          -9.267819e-02 -0.0928020715 -0.0929682024
-0.0931377281 -0.0933068785 -0.0934715336
age_16           2.209295e-01  0.2211067168  0.2212750054
0.2214323144  0.2215853031  0.2217314912
age_17           1.424031e-01  0.1425079195  0.1426083965
0.1426850571  0.1427486824  0.1428080720
age_18          -3.441386e-01 -0.3443522821 -0.3445054475
-0.3446146275 -0.3447042450 -0.3447851542
              4e-04
(Intercept)    -1.6270318659
absences        0.0438204968
G1              0.2372566843
G2              0.8879416131
sex_F          -0.1019766322
sex_M           0.1019766322
age_15          -0.0936294082
age_16           0.2218694582
age_17           0.1428663347
age_18          -0.3448613600
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5.257679 5.260027 5.262183 5.264158

\$cvse

[1] 1.8531956 1.6877921 1.5251681 1.3969994 1.2959492 1.2159773
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[11] 0.9950512 0.9701912 0.9487280 0.9299879 0.9134707 0.8979745
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\$lambda

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\$fit

\$beta

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2.6858    2.4472    2.2298    2.0317
(Intercept)      10.68592  9.62284873  8.6542173  7.7716363
6.9674615  6.234727  5.5670872  4.9587584
absences          0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000
G1              0.00000  0.00000000  0.0000000  0.0000000
0.0000000  0.000000  0.0000000  0.0000000
G2              0.00000  0.09724931  0.1858593  0.2665973
0.3401629  0.407193  0.4682684  0.5239181
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sex_F	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
sex_M	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
age_15	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
age_16	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
age_17	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
age_18	0.00000	0.00000000	0.0000000	0.0000000
	0.0000000	0.000000	0.0000000	0.0000000
		1.8512	1.6867	1.5369
				1.4004
	1.276	1.1626	1.0593	0.9652
(Intercept)	4.4044718	3.8994266	3.4392481	3.0199507
	2.6379025	2.2897944	1.9726112	1.675718610
absences	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
G1	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.002823149
G2	0.5746239	0.6208252	0.6629221	0.7012793
	0.7362289	0.7680736	0.7970894	0.821374563
sex_F	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
sex_M	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
age_15	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
age_16	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
age_17	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
age_18	0.0000000	0.0000000	0.0000000	0.0000000
	0.0000000	0.0000000	0.0000000	0.0000000000
		0.8795	0.8013	0.7302
				0.6653
	0.6062	0.5523	0.5033	
(Intercept)	1.37076945	1.09422071	0.84201347	0.61245187
	0.40328875	0.21270721	0.03881413	

absences	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
G1	0.01772002	0.03082474	0.04284628	0.05371387
	0.06361427	0.07263512	0.08094129	
G2	0.83410372	0.84605951	0.85689141	0.86682661
	0.87588052	0.88413013	0.89158074	
sex_F	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
sex_M	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_15	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_16	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_17	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_18	0.00000000	0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
		0.4586	0.4178	0.3807
0.3469	0.3161	0.288	0.2624	
(Intercept)		-0.11939548	-0.26354340	-0.3948854
	-0.5147997	-0.6238307	-0.7231662	-0.8136766
absences		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
G1		0.08842535	0.09524212	0.1014532
	0.1071986	0.1123511	0.1170424	0.1213169
G2		0.89843368	0.90467968	0.9103709
	0.9154908	0.9202189	0.9245295	0.9284573
sex_F		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
sex_M		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_15		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_16		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	
age_17		0.00000000	0.00000000	0.00000000
	0.00000000	0.00000000	0.00000000	

age_18		0.00000000	0.00000000	0.00000000
0.00000000	0.00000000	0.00000000	0.00000000	
		0.2391	0.2179	0.1985
0.1809	0.1648	0.1502		
(Intercept)		-0.8963858	-0.981921726	-1.081752927
-1.172225046	-1.263847891	-1.355807106		
absences		0.00000000	0.000000000	0.002395194
0.004697556	0.006767869	0.008639554		
G1		0.1252973	0.129327271	0.133994042
0.137821298	0.141555651	0.145541582		
G2		0.9319707	0.934586399	0.936383210
0.938347457	0.940362808	0.942099770		
sex_F		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
sex_M		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
age_15		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
age_16		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
age_17		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
age_18		0.00000000	0.000000000	0.000000000
0.000000000	0.000000000	0.000000000		
		0.1368	0.1247	0.1136
0.1035	0.0943	0.0859		
(Intercept)		-1.450842348	-1.539352219	-1.6204444261
-1.6889042593	-1.7514840742	-1.809330311		
absences		0.010566010	0.012514655	0.0142900343
0.0160154326	0.0177178222	0.019420805		
G1		0.149832318	0.154898079	0.1602017436
0.1674635785	0.1741614193	0.179766834		
G2		0.943463323	0.943613424	0.9433692158
0.9415891168	0.9400751249	0.939106327		
sex_F		0.000000000	0.000000000	0.0000000000
-0.0117515957	-0.0237641760	-0.035680167		
sex_M		0.000000000	0.000000000	0.0000000000
0.0117515957	0.0237641760	0.035680167		

age_15	0.000000000	0.002803188	0.0053853476
0.0064682667	0.0064418750	0.004992935	
age_16	0.000000000	0.011655155	0.0232273870
0.0346202414	0.0452395046	0.054967516	
age_17	0.000000000	0.006269931	0.0117838696
0.0174733820	0.0226794499	0.027186397	
age_18	0.000000000	-0.023886783	-0.0465585544
-0.0676057532	-0.0859915010	-0.100989430	
	0.0783	0.0713	0.065
0.0592	0.054	0.0492	
(Intercept)	-1.8628659829	-1.9043012894	-1.934457653
-1.959360328	-1.983200890	-2.0029458166	
absences	0.0210444775	0.0224511042	0.023852626
0.025145240	0.026322815	0.0274290745	
G1	0.1849412853	0.1901717773	0.194719600
0.198088664	0.201643497	0.2048731774	
G2	0.9382081834	0.9371104271	0.936294078
0.936174464	0.935780196	0.9354905953	
sex_F	-0.0472897832	-0.0582728960	-0.066412437
-0.073718412	-0.080570260	-0.0869388468	
sex_M	0.0472897832	0.0582728960	0.066412437
0.073718412	0.080570260	0.0869388468	
age_15	0.0026408938	-0.0006125954	-0.003889025
-0.007439496	-0.011220750	-0.0149536957	
age_16	0.0646759600	0.0741634208	0.082373857
0.089850464	0.097050825	0.1037177606	
age_17	0.0314837172	0.0354725692	0.038717443
0.041650565	0.044404102	0.0469194412	
age_18	-0.1147447377	-0.1269098334	-0.136698510
-0.144974414	-0.152470522	-0.1591209761	
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0.0339	0.0309	0.0281	
(Intercept)	-2.0140899109	-2.0262640387	-2.036210e+00
-2.0444822311	-2.0513562224	-2.0570668062	
absences	0.0284936350	0.0294991728	3.041723e-02
0.0312611940	0.0320364624	0.0327480876	
G1	0.2068649978	0.2088453814	2.106698e-01
0.2123784538	0.2139851386	0.2154994271	

G2	0.9359025759	0.9362897336	9.366318e-01
0.9369219426	0.9371610738	0.9373525089	
sex_F	-0.0929609360	-0.0989507745	-1.045620e-01
-0.1098412497	-0.1147987873	-0.1194451014	
sex_M	0.0929609360	0.0989507745	1.045620e-01
0.1098412497	0.1147987873	0.1194451014	
age_15	-0.0183182967	-0.0216737307	-2.505863e-02
-0.0284553338	-0.0318432809	-0.0352035164	
age_16	0.1093385786	0.1145371818	1.192476e-01
0.1235431272	0.1274587771	0.1310253350	
age_17	0.0489775119	0.0513626016	5.357891e-02
0.0556883484	0.0577111369	0.0596623934	
age_18	-0.1644201487	-0.1696184584	-1.740205e-01
-0.1778026351	-0.1810514006	-0.1838406766	
	0.0256	0.0234	0.0213
0.0194	0.0177	0.0161	
(Intercept)	-2.061813996	-2.065767489	-2.067016387
-2.067560272	-2.0678237919	-2.0685072669	
absences	0.033400813	0.033999090	0.034554867
0.035099762	0.0355821025	0.0360163862	
G1	0.216928576	0.218278345	0.219627530
0.220861943	0.2220828606	0.2233806208	
G2	0.937500530	0.937609773	0.937607975
0.937590140	0.9375173619	0.9373288747	
sex_F	-0.123791335	-0.127849192	-0.131860729
-0.135540991	-0.1389719315	-0.1421350312	
sex_M	0.123791335	0.127849192	0.131860729
0.135540991	0.1389719315	0.1421350312	
age_15	-0.038518683	-0.041773025	-0.044764820
-0.047368684	-0.0500533388	-0.0527512675	
age_16	0.134270715	0.137220497	0.139921501
0.142643066	0.1448875832	0.1466062433	
age_17	0.061552968	0.063390086	0.065287607
0.067059127	0.0688152972	0.0706426812	
age_18	-0.186234326	-0.188287548	-0.190405296
-0.192819574	-0.1945735915	-0.1957842452	
	0.0147	0.0134	0.0122
0.0111	0.0101	0.0092	

(Intercept)	-2.070396643	-2.0718193625	-2.0731636771
	-2.0743812376	-2.075473551	-2.076454301
absences	0.036440795	0.0368206815	0.0371667838
	0.0374824766	0.037770406	0.038032968
G1	0.224444154	0.2255050962	0.2265303828
	0.2275013298	0.228413366	0.229266708
G2	0.937239227	0.9370901164	0.9369222414
	0.9367506392	0.936581111	0.936416195
sex_F	-0.145423737	-0.1484200504	-0.1511799409
	-0.1537232857	-0.156065009	-0.158219142
sex_M	0.145423737	0.1484200504	0.1511799409
	0.1537232857	0.156065009	0.158219142
age_15	-0.055273388	-0.0577784917	-0.0601720480
	-0.0624491546	-0.064607769	-0.066647556
age_16	0.148252000	0.1495133797	0.1506305946
	0.1516248730	0.152508468	0.153292924
age_17	0.072539166	0.0744073985	0.0762126394
	0.0779464673	0.079605538	0.081187812
age_18	-0.197180460	-0.1981149318	-0.1989289000
	-0.1996425652	-0.200268500	-0.200818129
		0.0084	0.0076
			0.007
	0.0064	0.0058	0.0053
(Intercept)	-2.079348244	-2.082279194	-2.0852367424
	-2.088675928	-2.091513671	-2.094190798
absences	0.038274016	0.038510048	0.0387111138
	0.038895172	0.039068103	0.039224125
G1	0.230171246	0.230767271	0.2314439000
	0.231941276	0.232416065	0.232882670
G2	0.936175984	0.936121538	0.9360001654
	0.936046849	0.936061538	0.936055561
sex_F	-0.160241145	-0.162218015	-0.1640082244
	-0.165448295	-0.166923321	-0.168273349
sex_M	0.160241145	0.162218015	0.1640082244
	0.165448295	0.166923321	0.168273349
age_15	-0.068757662	-0.070665144	-0.0725711828
	-0.073733779	-0.075114421	-0.076419410
age_16	0.153735008	0.154467354	0.1548905187
	0.155929645	0.156523766	0.157015813

age_17		0.082770498	0.084019692	0.0852193197
0.085933591	0.086784880	0.087608904		
age_18		-0.200893864	-0.201138262	-0.2009667826
-0.201750672	-0.201940559	-0.202061702		
		0.0048	0.0044	0.004
0.0036	0.0033	0.003		
(Intercept)		-2.0971439198	-2.099321904	-2.101434137
-2.103470765	-2.105401872	-2.107211205		
absences		0.0393607871	0.039470921	0.039574228
0.039667276	0.039751782	0.039828692		
G1		0.2334196398	0.233770989	0.234134056
0.234490404	0.234830420	0.235150213		
G2		0.9359887462	0.935962822	0.935926258
0.935881137	0.935832512	0.935783151		
sex_F		-0.1695578518	-0.170530340	-0.171499663
-0.172386281	-0.173197511	-0.173940426		
sex_M		0.1695578518	0.170530340	0.171499663
0.172386281	0.173197511	0.173940426		
age_15		-0.0778948238	-0.078992174	-0.080142558
-0.081210088	-0.082192091	-0.083094888		
age_16		0.1572195755	0.157901538	0.158363309
0.158753583	0.159104634	0.159423368		
age_17		0.0885967007	0.089246573	0.089923006
0.090572190	0.091176560	0.091735408		
age_18		-0.2018537952	-0.202217665	-0.202298915
-0.202354801	-0.202405328	-0.202450874		
		0.0027	0.0025	0.0023
0.0021	0.0019	0.0017		
(Intercept)		-2.108812391	-2.110264306	-2.111620478
-2.1129082914	-2.1141230626	-2.1152587957		
absences		0.039892718	0.039959625	0.040019204
0.0400726503	0.0401210402	0.0401650235		
G1		0.235390754	0.235632628	0.235869779
0.2360992709	0.2363176754	0.2365230236		
G2		0.935758103	0.935729575	0.935694990
0.9356569506	0.9356177163	0.9355787448		
sex_F		-0.174505989	-0.175140873	-0.175726898
-0.1762594607	-0.1767443311	-0.1771865769		

sex_M	0.174505989	0.175140873	0.175726898
0.1762594607	0.1767443311	0.1771865769	
age_15	-0.083707142	-0.084452867	-0.085169162
-0.0858304217	-0.0864363826	-0.0869912204	
age_16	0.159815088	0.160123873	0.160367711
0.1605767278	0.1607628565	0.1609308940	
age_17	0.092194731	0.092628985	0.093052799
0.0934548640	0.0938294407	0.0941757658	
age_18	-0.202779515	-0.202838246	-0.202841062
-0.2028375256	-0.2028351306	-0.2028340572	
	0.0016	0.0014	0.0013
	0.0012	0.0011	0.001
(Intercept)	-2.1163139818	-2.1172903359	-2.1179407749
-2.118916e+00	-2.1194647801	-2.1201001215	
absences	0.0402050515	0.0402414929	0.0402579149
4.030675e-02	0.0403202946	0.0403444593	
G1	0.2367146004	0.2368924275	0.2369831743
2.371700e-01	0.2372534804	0.2373525062	
G2	0.9355409132	0.9355047286	0.9354886656
9.354575e-01	0.9354402900	0.9354263146	
sex_F	-0.1775902104	-0.1779586595	-0.1781384540
-1.785921e-01	-0.1787556465	-0.1789768391	
sex_M	0.1775902104	0.1779586595	0.1781384540
1.785921e-01	0.1787556465	0.1789768391	
age_15	-0.0874992444	-0.0879643370	-0.0882146571
-8.872986e-02	-0.0889708210	-0.0892198012	
age_16	0.1610832167	0.1612214484	0.1613992545
1.615139e-01	0.1616420304	0.1617754034	
age_17	0.0944949015	0.0947884652	0.0950008757
9.526331e-02	0.0954512040	0.0956324031	
age_18	-0.2028336500	-0.2028334846	-0.2030170313
-2.028991e-01	-0.2030063788	-0.2031033538	
	9e-04	8e-04	7e-04
	7e-04	6e-04	6e-04
(Intercept)	-2.1206878524	-2.1212301194	-2.1217346228
-2.1222079927	-2.1226535372	-2.1230723564	
absences	0.0403696579	0.0403926523	0.0404132681
0.0404317250	0.0404483030	0.0404632540	

```

G1                0.2374505292  0.2375455463  0.2376372594
0.2377254532  0.2378097794  0.2378898806
G2                0.9354117352  0.9353957876  0.9353786093
0.9353606287  0.9353422934  0.9353239879
sex_F            -0.1792157366 -0.1794445875 -0.1796556728
-0.1798479563 -0.1800224387 -0.1801806832
sex_M            0.1792157366  0.1794445875  0.1796556728
0.1798479563  0.1800224387  0.1801806832
age_15          -0.0895012733 -0.0897819064 -0.0900479899
-0.0902949079 -0.0905217040 -0.0907290057
age_16           0.1618880752  0.1619775628  0.1620490154
0.1621077898  0.1621575353  0.1622006072
age_17           0.0958014141  0.0959626567  0.0961172618
0.0962643626  0.0964028812  0.0965321785
age_18          -0.2031269468 -0.2031154304 -0.2030909280
-0.2030636524 -0.2030376293 -0.2030141776
                    5e-04          5e-04          4e-04
          4e-04
(Intercept)      -2.1234647488 -2.1238309845 -2.124171586
-2.124487365
absences         0.0404767831  0.0404890553  0.040500205
0.040510345
G1               0.2379654902  0.2380364669  0.238102787
0.238164520
G2               0.9353060132  0.9352885911  0.935271876
0.935255970
sex_F           -0.1803242904 -0.1804547249 -0.180573283
-0.180681107
sex_M           0.1803242904  0.1804547249  0.180573283
0.180681107
age_15          -0.0909180989 -0.0910904643 -0.091247566
-0.091390772
age_16           0.1622385387  0.1622723397  0.162302693
0.162330082
age_17           0.0966521050  0.0967628573  0.096864834
0.096958537
age_18          -0.2029935176 -0.2029754533 -0.202959661
-0.202945808
[ reached getOption("max.print") -- omitted 90 rows ]

```


$$MSE_{glasso} = 5.96$$

e)

We can see that creating the new groupings has not yielded an advantage in terms of decreasing the MSE, and the same variable groups seem to be selected.

When comparing Lasso to the Group Lasso methods, we can see that the G1, and G2 variables seem to be consistently performing when predicting against the target variable compared to the rest of the features.