Assignment 9
MN Logit & Ordered Logit Models

The model

In the study of problems of the business, the most serious problem was the price-war. The analysis is trying to estimate the model that determines factors that have impact on the degree of seriousness of the problem.

$$Prob(y_i=j|X) = f(x_1, x_2, x_3, x_4)$$

where: y_i is categorical data = 0 for no problem, = 1 for less serious, …, and = 5 for very serious, and $i=1$ or 2.
x_1 is dummy variable = 0 for nonfamily firm and =1 for family firm.
x_2 is dummy variable = 0 for no brand and =1 for have own-brand name.
x_3 is dummy variable = 0 for low technology and =1 for high technology firm.
x_4 is log of the size of the firm.

Requirements: From data file – `Assign09.dta`:

1. Estimate the model using multinomial logit of y_i. Perform IIA test. Interpret your estimated result (overall test, individual test, pseudo R^2, counted R^2).
2. Estimate the model using order logit of y_i. Interpret your estimated result (overall test, individual test, pseudo R^2, counted R^2).
3. From (a) and (b), compare the two models. Perform order logit test. Which model is more appropriated in this case? Why?
4. Compute marginal effect at mean and median of both models.

1)

```
. mlogit y x1 x2 x3 x4

Iteration 0:   log likelihood = -228.64363
Iteration 1:   log likelihood = -204.50752
Iteration 2:   log likelihood = -203.29728
Iteration 3:   log likelihood = -203.28338
Iteration 4:   log likelihood = -203.28337

Multinomial logistic regression                 Number of obs     =        152
                                                LR chi2(20)       =      50.72
                                                Prob > chi2       =     0.0002
Log likelihood = -203.28337                     Pseudo R2         =     0.1109
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0						
x1	-1.832363	.8632903	-2.12	0.034	-3.524381	-.1403452
x2	2.368735	1.168139	2.03	0.043	.079224	4.658246
x3	-.0976971	.8455682	-0.12	0.908	-1.75498	1.559586
x4	-.4905651	.3468626	-1.41	0.157	-1.170403	.189273
_cons	4.204706	4.763082	0.88	0.377	-5.130762	13.54017
1						
x1	-1.954381	.814615	-2.40	0.016	-3.550997	-.3577647
x2	.3523473	.782471	0.45	0.652	-1.181268	1.885962
x3	1.155726	1.030763	1.12	0.262	-.864533	3.175985
x4	.8167134	.4673336	1.75	0.081	-.0992436	1.732671
_cons	-13.86033	7.056818	-1.96	0.050	-27.69144	-.0292169
2						
x1	-.8623688	.6749745	-1.28	0.201	-2.185294	.4605568
x2	.7376981	.6909685	1.07	0.286	-.6165753	2.091972
x3	-1.132118	.6624929	-1.71	0.087	-2.43058	.1663445
x4	-.2862948	.2878698	-0.99	0.320	-.8505092	.2779195
_cons	3.302474	4.043716	0.82	0.414	-4.623064	11.22801
3						
x1	-2.236402	.6199683	-3.61	0.000	-3.451518	-1.021287
x2	1.415342	.6376614	2.22	0.026	.1655491	2.665136
x3	-.2635344	.6026228	-0.44	0.662	-1.444653	.9175846
x4	-.2730998	.2507716	-1.09	0.276	-.7646032	.2184035
_cons	3.142763	3.534705	0.89	0.374	-3.785131	10.07066
4						
x1	-.1544581	.5644404	-0.27	0.784	-1.260741	.9518248
x2	.2643829	.5265539	0.50	0.616	-.7676439	1.29641
x3	-1.307232	.5372575	-2.43	0.015	-2.360237	-.2542264
x4	-.3073979	.2338932	-1.31	0.189	-.7658201	.1510242
_cons	4.187597	3.285728	1.27	0.202	-2.252312	10.62751
5	(base outcome)					

```
. fitstat

Measures of Fit for mlogit of y

Log-Lik Intercept Only:     -228.644     Log-Lik Full Model:          -203.283
D(122):                      406.567     LR(20):                       50.721
                                         Prob > LR:                     0.000
McFadden's R2:                 0.111     McFadden's Adj R2:            -0.020
Maximum Likelihood R2:         0.284     Cragg & Uhler's R2:            0.298
Count R2:                      0.086     Adj Count R2:                  0.021
AIC:                           3.070     AIC*n:                       466.567
BIC:                        -206.347     BIC':                         49.757

. est store m1
. mlogit y x1 x2 x3 x4 if y!=4

Iteration 0:   log likelihood = -160.69745
Iteration 1:   log likelihood =  -139.7611
Iteration 2:   log likelihood =  -138.7881
Iteration 3:   log likelihood = -138.77638
Iteration 4:   log likelihood = -138.77638

Multinomial logistic regression                 Number of obs     =        127
                                                LR chi2(16)       =      43.84
                                                Prob > chi2       =     0.0002
Log likelihood = -138.77638                     Pseudo R2         =     0.1364
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0						
x1	-1.917478	.8656523	-2.22	0.027	-3.614125	-.2208305
x2	2.399049	1.184989	2.02	0.043	.0765135	4.721585
x3	-.0750429	.8626823	-0.09	0.931	-1.765869	1.615783
x4	-.4760917	.3418197	-1.39	0.164	-1.146046	.1938626
_cons	4.002073	4.712976	0.85	0.396	-5.235191	13.23934
1						
x1	-1.887951	.8108206	-2.33	0.020	-3.47713	-.2987722
x2	.4256484	.7803751	0.55	0.585	-1.103859	1.955155
x3	1.13251	1.04128	1.09	0.277	-.9083626	3.173382
x4	.7670503	.4586998	1.67	0.094	-.1319848	1.666086
_cons	-13.20158	6.968	-1.89	0.058	-26.85861	.455447
2						
x1	-.902955	.6677474	-1.35	0.176	-2.211716	.4058058
x2	.746173	.6920624	1.08	0.281	-.6102444	2.10259
x3	-1.134476	.6573489	-1.73	0.084	-2.422856	.1539042
x4	-.2704256	.2800586	-0.97	0.334	-.8193303	.2784791
_cons	3.098155	3.947385	0.78	0.433	-4.638579	10.83489
3						
x1	-2.273025	.6227095	-3.65	0.000	-3.493514	-1.052537
x2	1.445561	.6553098	2.21	0.027	.1611778	2.729945
x3	-.2614692	.6184131	-0.42	0.672	-1.473537	.9505983
x4	-.277248	.2489175	-1.11	0.265	-.7651174	.2106213
_cons	3.19799	3.521038	0.91	0.364	-3.703118	10.0991
5	(base outcome)					

```
. est store m2
```

```
. hausman m2 m1, alleqs constant

Note: the rank of the differenced variance matrix (19) does not equal the
        number of coefficients being tested (20); be sure this is what you
        expect, or there may be problems computing the test.  Examine the
        output of your estimators for anything unexpected and possibly consider
        scaling your variables so that the coefficients are on a similar scale.
```

	Coefficients (b) m2	(B) m1	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
0				
x1	-1.917478	-1.832363	-.0851147	.0639035
x2	2.399049	2.368735	.0303146	.1991226
x3	-.0750429	-.0976971	.0226542	.1709826
x4	-.4760917	-.4905651	.0144735	.
_cons	4.002073	4.204706	-.2026339	.
1				
x1	-1.887951	-1.954381	.0664294	.
x2	.4256484	.3523473	.0733011	.
x3	1.13251	1.155726	-.0232167	.1476198
x4	.7670503	.8167134	-.0496631	.
_cons	-13.20158	-13.86033	.6587452	.
2				
x1	-.902955	-.8623688	-.0405861	.
x2	.746173	.7376981	.0084748	.0388948
x3	-1.134476	-1.132118	-.0023583	.
x4	-.2704256	-.2862948	.0158692	.
_cons	3.098155	3.302474	-.2043196	.
3				
x1	-2.273025	-2.236402	-.036623	.0583652
x2	1.445561	1.415342	.030219	.1510594
x3	-.2614692	-.2635344	.0020652	.1388544
x4	-.277248	-.2730998	-.0041482	.
_cons	3.19799	3.142763	.0552263	.

```
                b = consistent under Ho and Ha; obtained from mlogit
     B = inconsistent under Ha, efficient under Ho; obtained from mlogit

  Test:  Ho:  difference in coefficients not systematic

              chi2(19) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                       =          1.74
            Prob>chi2 =        1.0000
            (V_b-V_B is not positive definite)
```

It fails to reject the null hypothesis an implies that MN logit is appropriated, IAA is valid.

2)

```
. mlogit y x1 x2 x3 x4, nolog

Multinomial logistic regression                 Number of obs     =        152
                                                LR chi2(20)       =      50.72
                                                Prob > chi2       =     0.0002
Log likelihood = -203.28337                     Pseudo R2         =     0.1109
```

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0						
x1	-1.832363	.8632903	-2.12	0.034	-3.524381	-.1403452
x2	2.368735	1.168139	2.03	0.043	.079224	4.658246
x3	-.0976971	.8455682	-0.12	0.908	-1.75498	1.559586
x4	-.4905651	.3468626	-1.41	0.157	-1.170403	.189273
_cons	4.204706	4.763082	0.88	0.377	-5.130762	13.54017
1						
x1	-1.954381	.814615	-2.40	0.016	-3.550997	-.3577647
x2	.3523473	.782471	0.45	0.652	-1.181268	1.885962
x3	1.155726	1.030763	1.12	0.262	-.864533	3.175985
x4	.8167134	.4673336	1.75	0.081	-.0992436	1.732671
_cons	-13.86033	7.056818	-1.96	0.050	-27.69144	-.0292169
2						
x1	-.8623688	.6749745	-1.28	0.201	-2.185294	.4605568
x2	.7376981	.6909685	1.07	0.286	-.6165753	2.091972
x3	-1.132118	.6624929	-1.71	0.087	-2.43058	.1663445
x4	-.2862948	.2878698	-0.99	0.320	-.8505092	.2779195
_cons	3.302474	4.043716	0.82	0.414	-4.623064	11.22801

Continued.

3						
x1	-2.236402	.6199683	-3.61	0.000	-3.451518	-1.021287
x2	1.415342	.6376614	2.22	0.026	.1655491	2.665136
x3	-.2635344	.6026228	-0.44	0.662	-1.444653	.9175846
x4	-.2730998	.2507716	-1.09	0.276	-.7646032	.2184035
_cons	3.142763	3.534705	0.89	0.374	-3.785131	10.07066
4						
x1	-.1544581	.5644404	-0.27	0.784	-1.260741	.9518248
x2	.2643829	.5265539	0.50	0.616	-.7676439	1.29641
x3	-1.307232	.5372575	-2.43	0.015	-2.360237	-.2542264
x4	-.3073979	.2338932	-1.31	0.189	-.7658201	.1510242
_cons	4.187597	3.285728	1.27	0.202	-2.252312	10.62751
5	(base outcome)					

```
. fitstat

Measures of Fit for mlogit of y

Log-Lik Intercept Only:     -228.644     Log-Lik Full Model:          -203.283
D(122):                      406.567     LR(20):                       50.721
                                         Prob > LR:                     0.000
McFadden's R2:                 0.111     McFadden's Adj R2:            -0.020
Maximum Likelihood R2:         0.284     Cragg & Uhler's R2:            0.298
Count R2:                      0.086     Adj Count R2:                  0.021
AIC:                           3.070     AIC*n:                       466.567
BIC:                        -206.347     BIC':                         49.757

. est store m3
```

```
12 . fitstat

Measures of Fit for mlogit of y

Log-Lik Intercept Only:      -228.644     Log-Lik Full Model:          -203.283
D(122):                       406.567     LR(20):                       50.721
                                          Prob > LR:                     0.000
McFadden's R2:                  0.111     McFadden's Adj R2:            -0.020
Maximum Likelihood R2:          0.284     Cragg & Uhler's R2:            0.298
Count R2:                       0.086     Adj Count R2:                  0.021
AIC:                            3.070     AIC*n:                       466.567
BIC:                         -206.347     BIC':                         49.757

13 . est store m3

14 . est table m1 m3
```

Variable	m1	m3
0		
x1	-1.8323631	-1.8323631
x2	2.3687348	2.3687348
x3	-.09769711	-.09769711
x4	-.49056514	-.49056514
_cons	4.2047064	4.2047064
1		
x1	-1.9543807	-1.9543807
x2	.3523473	.3523473
x3	1.1557262	1.1557262
x4	.81671345	.81671345
_cons	-13.860326	-13.860326
2		
x1	-.86236881	-.86236881
x2	.73769811	.73769811
x3	-1.1321177	-1.1321177
x4	-.28629483	-.28629483
_cons	3.3024743	3.3024743
3		
x1	-2.2364025	-2.2364025
x2	1.4153424	1.4153424
x3	-.26353438	-.26353438
x4	-.27309984	-.27309984
_cons	3.1427635	3.1427635
4		
x1	-.15445807	-.15445807
x2	.2643829	.2643829
x3	-1.3072318	-1.3072318
x4	-.30739795	-.30739795
_cons	4.1875969	4.1875969
5		
x1	(omitted)	(omitted)
x2	(omitted)	(omitted)
x3	(omitted)	(omitted)
x4	(omitted)	(omitted)
_cons	(omitted)	(omitted)

```
15 . mlogit y x1 x2 x3 x4, nolog
```

Multinomial logistic regression — Number of obs = 152; LR chi2(20) = 50.72; Prob > chi2 = 0.0002; Log likelihood = -203.28337; Pseudo R2 = 0.1109

y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
0						
x1	-1.832363	.8632903	-2.12	0.034	-3.524381	-.1403452
x2	2.368735	1.168139	2.03	0.043	.079224	4.658246
x3	-.0976971	.8455682	-0.12	0.908	-1.75498	1.559586
x4	-.4905651	.3468626	-1.41	0.157	-1.170403	.189273
_cons	4.204706	4.763082	0.88	0.377	-5.130762	13.54017
1						
x1	-1.954381	.814615	-2.40	0.016	-3.550997	-.3577647
x2	.3523473	.782471	0.45	0.652	-1.181268	1.885962
x3	1.155726	1.030763	1.12	0.262	-.864533	3.175985
x4	.8167134	.4673336	1.75	0.081	-.0992436	1.732671
_cons	-13.86033	7.056818	-1.96	0.050	-27.69144	-.0292169
2						
x1	-.8623688	.6749745	-1.28	0.201	-2.185294	.4605568
x2	.7376981	.6909685	1.07	0.286	-.6165753	2.091972
x3	-1.132118	.6624929	-1.71	0.087	-2.43058	.1663445
x4	-.2862948	.2878698	-0.99	0.320	-.8505092	.2779195
_cons	3.302474	4.043716	0.82	0.414	-4.623064	11.22801
3						
x1	-2.236402	.6199683	-3.61	0.000	-3.451518	-1.021287
x2	1.415342	.6376614	2.22	0.026	.1655491	2.665136
x3	-.2635344	.6026228	-0.44	0.662	-1.444653	.9175846
x4	-.2730998	.2507716	-1.09	0.276	-.7646032	.2184035
_cons	3.142763	3.534705	0.89	0.374	-3.785131	10.07066
4						
x1	-.1544581	.5644404	-0.27	0.784	-1.260741	.9518248
x2	.2643829	.5265539	0.50	0.616	-.7676439	1.29641
x3	-1.307232	.5372575	-2.43	0.015	-2.360237	-.2542264
x4	-.3073979	.2338932	-1.31	0.189	-.7658201	.1510242
_cons	4.187597	3.285728	1.27	0.202	-2.252312	10.62751
5	(base outcome)					

```
16 . tab y
```

y	Freq.	Percent	Cum.
0	29	12.89	12.89
1	14	6.22	19.11
2	27	12.00	31.11
3	33	14.67	45.78
4	35	15.56	61.33
5	87	38.67	100.00
Total	225	100.00	

```
17 . g y01=y>1

18 . tab y y01
```

y	y01 0	1	Total
0	**29**	**0**	**29**
1	**14**	**0**	**14**
2	**0**	**27**	**27**
3	**0**	**33**	**33**
4	**0**	**35**	**35**
5	**0**	**87**	**87**
Total	**43**	**182**	**225**

```
19 . drop y01

20 . g y01=y>0

21 . g y12=y>1

22 . g y23=y>2

23 . g y34=y>3

24 . g y45=y>4

25 . tab y y01
```

y	y01 0	1	Total
0	**29**	**0**	**29**
1	**0**	**14**	**14**
2	**0**	**27**	**27**
3	**0**	**33**	**33**
4	**0**	**35**	**35**
5	**0**	**87**	**87**
Total	**29**	**196**	**225**

```
26 . tab y y12
```

y	y12 0	1	Total
0	**29**	**0**	**29**
1	**14**	**0**	**14**
2	**0**	**27**	**27**
3	**0**	**33**	**33**
4	**0**	**35**	**35**
5	**0**	**87**	**87**
Total	**43**	**182**	**225**

```
27 . tab y y23
```

y	y23 0	1	Total
0	**29**	**0**	**29**
1	**14**	**0**	**14**
2	**27**	**0**	**27**
3	**0**	**33**	**33**
4	**0**	**35**	**35**
5	**0**	**87**	**87**
Total	**70**	**155**	**225**

```
28 . tab y y34
```

y	y34 0	1	Total
0	**29**	**0**	**29**
1	**14**	**0**	**14**
2	**27**	**0**	**27**
3	**33**	**0**	**33**
4	**0**	**35**	**35**
5	**0**	**87**	**87**
Total	**103**	**122**	**225**

```
29 . tab y y45
```

y	y45 0	1	Total
0	**29**	**0**	**29**
1	**14**	**0**	**14**
2	**27**	**0**	**27**
3	**33**	**0**	**33**
4	**35**	**0**	**35**
5	**0**	**87**	**87**
Total	**138**	**87**	**225**

```
30 . logit y01 x1 x2 x3 x4

Iteration 0:   log likelihood = -34.168036
Iteration 1:   log likelihood = -31.212131
Iteration 2:   log likelihood = -30.495262
Iteration 3:   log likelihood =   -30.4838
Iteration 4:   log likelihood =  -30.48377
Iteration 5:   log likelihood =  -30.48377

Logistic regression                             Number of obs     =        152
                                                LR chi2(4)        =       7.37
                                                Prob > chi2       =     0.1176
Log likelihood =  -30.48377                     Pseudo R2         =     0.1078
```

y01	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	1.097122	.8131273	1.35	0.177	-.4965782	2.690822
x2	-1.82336	1.123595	-1.62	0.105	-4.025566	.3788458
x3	-.3069072	.7827279	-0.39	0.695	-1.841026	1.227211
x4	.3527502	.3128234	1.13	0.259	-.2603725	.9658728
_cons	-1.099312	4.270594	-0.26	0.797	-9.469521	7.270898

31 . logit y12 x1 x2 x3 x4

Iteration 0: log likelihood = **-57.269065**
Iteration 1: log likelihood = **-53.908783**
Iteration 2: log likelihood = **-53.703569**
Iteration 3: log likelihood = **-53.702831**
Iteration 4: log likelihood = **-53.702831**

Logistic regression — Number of obs = **152**
LR chi2(**4**) = **7.13**
Prob > chi2 = **0.1291**
Log likelihood = **-53.702831** — Pseudo R2 = **0.0623**

y12	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	1.264527	.5686274	2.22	0.026	.1500381	2.379017
x2	-.7792338	.6125997	-1.27	0.203	-1.979907	.4214395
x3	-.8053988	.6138821	-1.31	0.190	-2.008586	.397788
x4	-.2074297	.2514683	-0.82	0.409	-.7002985	.2854392
_cons	5.389609	3.618029	1.49	0.136	-1.701598	12.48082

32 . logit y23 x1 x2 x3 x4, nolog

Logistic regression — Number of obs = **152**
LR chi2(**4**) = **6.04**
Prob > chi2 = **0.1960**
Log likelihood = **-76.508097** — Pseudo R2 = **0.0380**

y23	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.864886	.445494	1.94	0.052	-.0082663	1.738038
x2	-.6170464	.4655784	-1.33	0.185	-1.529563	.2954705
x3	-.0281734	.4522084	-0.06	0.950	-.9144856	.8581388
x4	-.0449685	.1921363	-0.23	0.815	-.4215487	.3316117
_cons	1.899683	2.723582	0.70	0.485	-3.438441	7.237806

33 . logit y34 x1 x2 x3 x4, nolog

Logistic regression — Number of obs = **152**
LR chi2(**4**) = **26.27**
Prob > chi2 = **0.0000**
Log likelihood = **-86.898823** — Pseudo R2 = **0.1313**

y34	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	1.679889	.4162286	4.04	0.000	.8640956	2.495682
x2	-1.051402	.4278995	-2.46	0.014	-1.89007	-.2127347
x3	-.1154448	.419182	-0.28	0.783	-.9370264	.7061368
x4	.0623465	.1773535	0.35	0.725	-.2852601	.409953
_cons	-.4960081	2.501373	-0.20	0.843	-5.398609	4.406593

34 . logit y45 x1 x2 x3 x4, nolog

Logistic regression Number of obs = 152
LR chi2(4) = 24.72
Prob > chi2 = 0.0001
Log likelihood = -92.667503 Pseudo R2 = 0.1177

y45	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	1.213482	.399205	3.04	0.002	.4310541	1.995909
x2	-.8226954	.3937515	-2.09	0.037	-1.594434	-.0509566
x3	.672316	.4099034	1.64	0.101	-.1310799	1.475712
x4	.2113165	.176731	1.20	0.232	-.1350699	.5577028
_cons	-3.847181	2.497949	-1.54	0.124	-8.743071	1.048709

35 . est store logit45

36 . logit y34 x1 x2 x3 x4, nolog

Logistic regression Number of obs = 152
LR chi2(4) = 26.27
Prob > chi2 = 0.0000
Log likelihood = -86.898823 Pseudo R2 = 0.1313

y34	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	1.679889	.4162286	4.04	0.000	.8640956	2.495682
x2	-1.051402	.4278995	-2.46	0.014	-1.89007	-.2127347
x3	-.1154448	.419182	-0.28	0.783	-.9370264	.7061368
x4	.0623465	.1773535	0.35	0.725	-.2852601	.409953
_cons	-.4960081	2.501373	-0.20	0.843	-5.398609	4.406593

37 . est store logit34

38 . logit y23 x1 x2 x3 x4, nolog

Logistic regression Number of obs = 152
LR chi2(4) = 6.04
Prob > chi2 = 0.1960
Log likelihood = -76.508097 Pseudo R2 = 0.0380

y23	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.864886	.445494	1.94	0.052	-.0082663	1.738038
x2	-.6170464	.4655784	-1.33	0.185	-1.529563	.2954705
x3	-.0281734	.4522084	-0.06	0.950	-.9144856	.8581388
x4	-.0449685	.1921363	-0.23	0.815	-.4215487	.3316117
_cons	1.899683	2.723582	0.70	0.485	-3.438441	7.237806

```
39 . est store logit23

40 . logit y12 x1 x2 x3 x4, nolog

Logistic regression                             Number of obs     =        152
                                                LR chi2(4)        =       7.13
                                                Prob > chi2       =     0.1291
Log likelihood = -53.702831                     Pseudo R2         =     0.0623

------------------------------------------------------------------------------
         y12 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |    1.264527   .5686274     2.22   0.026     .1500381    2.379017
          x2 |   -.7792338   .6125997    -1.27   0.203    -1.979907    .4214395
          x3 |   -.8053988   .6138821    -1.31   0.190    -2.008586     .397788
          x4 |   -.2074297   .2514683    -0.82   0.409    -.7002985    .2854392
       _cons |    5.389609   3.618029     1.49   0.136    -1.701598    12.48082
------------------------------------------------------------------------------

41 . est store logit12

42 . logit y01 x1 x2 x3 x4, nolog

Logistic regression                             Number of obs     =        152
                                                LR chi2(4)        =       7.37
                                                Prob > chi2       =     0.1176
Log likelihood =  -30.48377                     Pseudo R2         =     0.1078

------------------------------------------------------------------------------
         y01 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |    1.097122   .8131273     1.35   0.177    -.4965782    2.690822
          x2 |    -1.82336   1.123595    -1.62   0.105    -4.025566    .3788458
          x3 |   -.3069072   .7827279    -0.39   0.695    -1.841026    1.227211
          x4 |    .3527502   .3128234     1.13   0.259    -.2603725    .9658728
       _cons |   -1.099312   4.270594    -0.26   0.797    -9.469521    7.270898
------------------------------------------------------------------------------

43 . est store logit01

44 . suest logit01 logit12 logit23 logit34 logit45

Simultaneous results for logit01, logit12, logit23, logit34, logit45

                                                Number of obs     =        152

------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
logit01_y01  |
          x1 |    1.097122   .9033857     1.21   0.225    -.6734812    2.867725
          x2 |    -1.82336   1.135405    -1.61   0.108    -4.048713    .4019928
          x3 |   -.3069072    .803698    -0.38   0.703    -1.882126    1.268312
          x4 |    .3527502   .3544918     1.00   0.320    -.3420409    1.047541
       _cons |   -1.099312   4.856106    -0.23   0.821     -10.6171    8.418481
-------------+----------------------------------------------------------------
logit12_y12  |
          x1 |    1.264527   .5825003     2.17   0.030     .1228478    2.406207
          x2 |   -.7792338    .604258    -1.29   0.197    -1.963558    .4050901
          x3 |   -.8053988   .6052151    -1.33   0.183    -1.991599     .380801
          x4 |   -.2074297   .3082284    -0.67   0.501    -.8115462    .3966868
       _cons |    5.389609   4.422033     1.22   0.223    -3.277416    14.05663
-------------+----------------------------------------------------------------
logit23_y23  |
```

x1	.864886	.4721274	1.83	0.067	-.0604667	1.790239
x2	-.6170464	.4658079	-1.32	0.185	-1.530013	.2959203
x3	-.0281734	.4629933	-0.06	0.951	-.9356237	.8792769
x4	-.0449685	.2176813	-0.21	0.836	-.4716161	.3816791
_cons	1.899683	3.086536	0.62	0.538	-4.149816	7.949182
logit34_y34						
x1	1.679889	.4359289	3.85	0.000	.8254838	2.534294
x2	-1.051402	.4339843	-2.42	0.015	-1.901996	-.2008088
x3	-.1154448	.4385046	-0.26	0.792	-.974898	.7440085
x4	.0623465	.1817055	0.34	0.732	-.2937897	.4184826
_cons	-.4960081	2.567482	-0.19	0.847	-5.52818	4.536164
logit45_y45						
x1	1.213482	.3980963	3.05	0.002	.4332271	1.993736
x2	-.8226954	.3994092	-2.06	0.039	-1.605523	-.0398677
x3	.672316	.4147506	1.62	0.105	-.1405801	1.485212
x4	.2113165	.1907187	1.11	0.268	-.1624853	.5851183
_cons	-3.847181	2.713683	-1.42	0.156	-9.165902	1.471539

```
45 . test [logit01_y01]x1=[logit12_y12]x1=[logit23_y23]x1=[logit34_y34]x1=logit45_
> y45]x1
too many ')' or ']'
r(132);
```

```
46 . test [logit01_y01]x1=[logit12_y12]x1=[logit23_y23]x1=[logit34_y34]x1=[logit45
> _y45]x1

 ( 1)  [logit01_y01]x1 - [logit12_y12]x1 = 0
 ( 2)  [logit01_y01]x1 - [logit23_y23]x1 = 0
 ( 3)  [logit01_y01]x1 - [logit34_y34]x1 = 0
 ( 4)  [logit01_y01]x1 - [logit45_y45]x1 = 0

           chi2(  4) =    6.95
         Prob > chi2 =    0.1384

47 .  test [logit01_y01]x2=[logit12_y12]x2=[logit23_y23]x2=[logit34_y34]x2=[logit4
> 5_y45]x2

 ( 1)  [logit01_y01]x2 - [logit12_y12]x2 = 0
 ( 2)  [logit01_y01]x2 - [logit23_y23]x2 = 0
 ( 3)  [logit01_y01]x2 - [logit34_y34]x2 = 0
 ( 4)  [logit01_y01]x2 - [logit45_y45]x2 = 0

           chi2(  4) =    3.24
         Prob > chi2 =    0.5186

48 . test [logit01_y01]x3=[logit12_y12]x3=[logit23_y23]x3=[logit34_y34]x3=[logit45
> _y45]x3

 ( 1)  [logit01_y01]x3 - [logit12_y12]x3 = 0
 ( 2)  [logit01_y01]x3 - [logit23_y23]x3 = 0
 ( 3)  [logit01_y01]x3 - [logit34_y34]x3 = 0
 ( 4)  [logit01_y01]x3 - [logit45_y45]x3 = 0

           chi2(  4) =    8.55
         Prob > chi2 =    0.0734
```

```
49 .  test [logit01_y01]x4=[logit12_y12]x4=[logit23_y23]x4=[logit34_y34]x4=[logit4
> 5_y45]x4

 ( 1)  [logit01_y01]x4 - [logit12_y12]x4 = 0
 ( 2)  [logit01_y01]x4 - [logit23_y23]x4 = 0
 ( 3)  [logit01_y01]x4 - [logit34_y34]x4 = 0
 ( 4)  [logit01_y01]x4 - [logit45_y45]x4 = 0

           chi2(  4) =    7.47
         Prob > chi2 =    0.1130

50 . mlogit y x1 x2 x3 x4, nolog

Multinomial logistic regression                 Number of obs     =        152
                                                LR chi2(20)       =      50.72
                                                Prob > chi2       =     0.0002
Log likelihood = -203.28337                     Pseudo R2         =     0.1109

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
          x1 |  -1.832363   .8632903    -2.12   0.034    -3.524381   -.1403452
          x2 |   2.368735   1.168139     2.03   0.043      .079224    4.658246
          x3 |  -.0976971   .8455682    -0.12   0.908     -1.75498    1.559586
          x4 |  -.4905651   .3468626    -1.41   0.157    -1.170403     .189273
       _cons |   4.204706   4.763082     0.88   0.377    -5.130762    13.54017
-------------+----------------------------------------------------------------
1            |
          x1 |  -1.954381    .814615    -2.40   0.016    -3.550997   -.3577647
          x2 |   .3523473    .782471     0.45   0.652    -1.181268    1.885962
          x3 |   1.155726   1.030763     1.12   0.262     -.864533    3.175985
          x4 |   .8167134   .4673336     1.75   0.081    -.0992436    1.732671
       _cons |  -13.86033   7.056818    -1.96   0.050    -27.69144   -.0292169
-------------+----------------------------------------------------------------
2            |
          x1 |  -.8623688   .6749745    -1.28   0.201    -2.185294    .4605568
          x2 |   .7376981   .6909685     1.07   0.286    -.6165753    2.091972
          x3 |  -1.132118   .6624929    -1.71   0.087     -2.43058    .1663445
          x4 |  -.2862948   .2878698    -0.99   0.320    -.8505092    .2779195
       _cons |   3.302474   4.043716     0.82   0.414    -4.623064    11.22801
-------------+----------------------------------------------------------------
3            |
          x1 |  -2.236402   .6199683    -3.61   0.000    -3.451518   -1.021287
          x2 |   1.415342   .6376614     2.22   0.026     .1655491    2.665136
          x3 |  -.2635344   .6026228    -0.44   0.662    -1.444653    .9175846
          x4 |  -.2730998   .2507716    -1.09   0.276    -.7646032    .2184035
       _cons |   3.142763   3.534705     0.89   0.374    -3.785131    10.07066
-------------+----------------------------------------------------------------
4            |
          x1 |  -.1544581   .5644404    -0.27   0.784    -1.260741    .9518248
          x2 |   .2643829   .5265539     0.50   0.616    -.7676439     1.29641
          x3 |  -1.307232   .5372575    -2.43   0.015    -2.360237   -.2542264
          x4 |  -.3073979   .2338932    -1.31   0.189    -.7658201    .1510242
       _cons |   4.187597   3.285728     1.27   0.202    -2.252312    10.62751
-------------+----------------------------------------------------------------
5            |  (base outcome)
------------------------------------------------------------------------------
```

```
51 . margins, dydx(*) predict(outcome(0))

Average marginal effects                        Number of obs     =        152
Model VCE    : OIM

Expression   : Pr(y==0), predict(outcome(0))
dy/dx w.r.t. : x1 x2 x3 x4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	-.049448	.0394996	-1.25	0.211	-.1268658	.0279698
x2	.0953594	.0625156	1.53	0.127	-.027169	.2178878
x3	.0128947	.0388471	0.33	0.740	-.0632443	.0890336
x4	-.0202353	.0163353	-1.24	0.215	-.0522519	.0117814

```
52 . margins, dydx(*) predict(outcome(1))

Average marginal effects                        Number of obs     =        152
Model VCE    : OIM

Expression   : Pr(y==1), predict(outcome(1))
dy/dx w.r.t. : x1 x2 x3 x4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	-.0770801	.0429311	-1.80	0.073	-.1612236	.0070633
x2	-.0090692	.0417711	-0.22	0.828	-.0909391	.0728007
x3	.0862353	.0585697	1.47	0.141	-.0285593	.2010298
x4	.0558661	.02814	1.99	0.047	.0007127	.1110196

```
53 . margins, dydx(*) predict(outcome(2))

Average marginal effects                        Number of obs     =        152
Model VCE    : OIM

Expression   : Pr(y==2), predict(outcome(2))
dy/dx w.r.t. : x1 x2 x3 x4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	-.010222	.0443173	-0.23	0.818	-.0970824	.0766384
x2	.0162247	.0506471	0.32	0.749	-.0830418	.1154912
x3	-.0705732	.048277	-1.46	0.144	-.1651944	.0240479
x4	-.0146586	.0203981	-0.72	0.472	-.0546381	.0253209

```
54 . margins, dydx(*) predict(outcome(3))

Average marginal effects                        Number of obs     =        152
Model VCE    : OIM

Expression   : Pr(y==3), predict(outcome(3))
dy/dx w.r.t. : x1 x2 x3 x4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	-.189127	.0587973	-3.22	0.001	-.3043675	-.0738865
x2	.1043358	.0651863	1.60	0.109	-.023427	.2320986
x3	.0071591	.0574438	0.12	0.901	-.1054288	.1197469
x4	-.0209355	.0234814	-0.89	0.373	-.0669581	.0250872

```
55 . margins, dydx(*) predict(outcome(4))

Average marginal effects                        Number of obs     =        152
Model VCE    : OIM

Expression   : Pr(y==4), predict(outcome(4))
dy/dx w.r.t. : x1 x2 x3 x4
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
x1	.077112	.0601692	1.28	0.200	-.0408174	.1950415
x2	-.0337673	.0612127	-0.55	0.581	-.1537419	.0862073
x3	-.1532631	.0608112	-2.52	0.012	-.2724508	-.0340753
x4	-.0312193	.0263643	-1.18	0.236	-.0828923	.0204538

```
56 . margins at median, dydx(*) predict(outcome(1))
variable at not found
r(111);

57 . margins, dydx(*) predict(outcome(1)) at median
option at not allowed
r(198);

58 . mfx

Marginal effects after mlogit
      y  = Pr(y==0) (predict)
         =  .04444813
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
x1*	-.0555962	.04366	-1.27	0.203	-.141164	.029971		.605263
x2*	.0718253	.03283	2.19	0.029	.007483	.136168		.664474
x3*	.0123912	.02934	0.42	0.673	-.045115	.069898		.690789
x4	-.0173643	.01412	-1.23	0.219	-.045038	.010309		14.3161

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
59 . mfx, at median
option at incorrectly specified
r(198);

60 . mfx, at(median)

Marginal effects after mlogit
      y  = Pr(y==0) (predict)
         =  .05043387
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
x1*	-.078538	.07484	-1.05	0.294	-.225213	.068137	1
x2*	.0445449	.02783	1.60	0.109	-.009995	.099085	1
x3*	.0138733	.03127	0.44	0.657	-.047406	.075153	1
x4	-.0211929	.01936	-1.09	0.274	-.059143	.016757	14.5087

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1

61 . log close
      name:  <unnamed>
       log:  C:\Users\Kang\Downloads\ASS9.smcl
  log type:  smcl
 closed on:  31 Mar 2021, 17:27:06
```