Assignment 9
MN Logit & Ordered Logit Models

1. Estimate the model using multinomial logit of y_i. Perform IIA test. Interpret your estimated result

Estimate the model

```
. 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)
------------------------------------------------------------------------------
```

```
. est store m1 # for IIA test
```

Estimate counted R square from fitstat

```
. 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
```

Perform IIA test

```
. mlogit y x1 x2 x3 x4 if y!=4 , nolog

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)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       m2           m1         Difference          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)
```

Interpretation
Overall test:
The model is jointly significant in overall test at 95% confidence (from p-value < 0.05)
Individual test:
most of the parameters are insignificant z-test
GOF and Forcasting error
pseudo R square is quite low
as well as counted R square that lower that 0.5 so, the model should be improved.

And lastly for the **IIA test** we accept the H0. So, the data is IIA the MN Logit is appropriated over the nested logit/ ASM Probit models.

2. Estimate the model using order logit of y_i. Interpret your estimated result

Estimate the model

```
ologit y x1 x2 x3 x4, nolog

Ordered logistic regression                     Number of obs     =        152
                                                LR chi2(4)        =      24.81
                                                Prob > chi2       =     0.0001
Log likelihood = -216.23748                     Pseudo R2         =     0.0543

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |    1.26067   .3475145     3.63   0.000      .5795538    1.941786
          x2 |  -.8530234   .3508641    -2.43   0.015     -1.540705   -.1653424
          x3 |   .2068371   .3398536     0.61   0.543     -.4592637    .8729379
          x4 |   .1261028   .1511501     0.83   0.404     -.1701459    .4223515
-------------+----------------------------------------------------------------
       /cut1 |  -.8807685   2.139511                     -5.074134    3.312597
       /cut2 |  -.0328063   2.126237                     -4.200155    4.134542
       /cut3 |   .6557008   2.118367                     -3.496223    4.807624
       /cut4 |    1.48964   2.117389                     -2.660365    5.639646
       /cut5 |   2.283969   2.124223                     -1.879432    6.447371
------------------------------------------------------------------------------
```

Interpretation

Overall test:

The model is jointly significant in overall test at 95% confidence (from p-value < 0.05)

Individual test:

most of the parameters are insignificant z-test more over all the cut are insignificant which is possible that the model is not order.

GOF and Forcasting error

pseudo R square is quite low

3. From (a) and (b), compare the two models. Perform order logit test. Which model is more appropriated in this case? Why?

Perform order logit test

```
gologit2 y x1 x2 x3 x4, pl sto(ologit) link(p)

Generalized Ordered Probit Estimates            Number of obs     =        152
                                                LR chi2(4)        =      23.50
                                                Prob > chi2       =     0.0001
Log likelihood = -216.89508                     Pseudo R2         =     0.0514

 ( 1)  [0]x1 - [1]x1 = 0
 ( 2)  [0]x2 - [1]x2 = 0
 ( 3)  [0]x3 - [1]x3 = 0
 ( 4)  [0]x4 - [1]x4 = 0
 ( 5)  [1]x1 - [2]x1 = 0
 ( 6)  [1]x2 - [2]x2 = 0
 ( 7)  [1]x3 - [2]x3 = 0
 ( 8)  [1]x4 - [2]x4 = 0
 ( 9)  [2]x1 - [3]x1 = 0
 (10)  [2]x2 - [3]x2 = 0
 (11)  [2]x3 - [3]x3 = 0
 (12)  [2]x4 - [3]x4 = 0
 (13)  [3]x1 - [4]x1 = 0
 (14)  [3]x2 - [4]x2 = 0
 (15)  [3]x3 - [4]x3 = 0
```

```
 (16)  [3]x4 - [4]x4 = 0
------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
          x1 |   .7194818   .2020884     3.56   0.000     .3233959    1.115568
          x2 |  -.5041496   .2049628    -2.46   0.014    -.9058693   -.1024299
          x3 |   .1109476   .2041695     0.54   0.587    -.2892173    .5111125
          x4 |   .0732426   .0867141     0.84   0.398    -.0967139    .2431991
       _cons |   .4623429   1.229346     0.38   0.707    -1.947131    2.871817
-------------+----------------------------------------------------------------
1            |
          x1 |   .7194818   .2020884     3.56   0.000     .3233959    1.115568
          x2 |  -.5041496   .2049628    -2.46   0.014    -.9058693   -.1024299
          x3 |   .1109476   .2041695     0.54   0.587    -.2892173    .5111125
          x4 |   .0732426   .0867141     0.84   0.398    -.0967139    .2431991
       _cons |   .0266402   1.224714     0.02   0.983    -2.373756    2.427036
-------------+----------------------------------------------------------------
2            |
          x1 |   .7194818   .2020884     3.56   0.000     .3233959    1.115568
          x2 |  -.5041496   .2049628    -2.46   0.014    -.9058693   -.1024299
          x3 |   .1109476   .2041695     0.54   0.587    -.2892173    .5111125
          x4 |   .0732426   .0867141     0.84   0.398    -.0967139    .2431991
       _cons |  -.3534276   1.220028    -0.29   0.772    -2.744639    2.037784
-------------+----------------------------------------------------------------
3            |
          x1 |   .7194818   .2020884     3.56   0.000     .3233959    1.115568
          x2 |  -.5041496   .2049628    -2.46   0.014    -.9058693   -.1024299
          x3 |   .1109476   .2041695     0.54   0.587    -.2892173    .5111125
          x4 |   .0732426   .0867141     0.84   0.398    -.0967139    .2431991
       _cons |  -.8395408   1.218495    -0.69   0.491    -3.227746    1.548665
-------------+----------------------------------------------------------------
4            |
          x1 |   .7194818   .2020884     3.56   0.000     .3233959    1.115568
          x2 |  -.5041496   .2049628    -2.46   0.014    -.9058693   -.1024299
          x3 |   .1109476   .2041695     0.54   0.587    -.2892173    .5111125
          x4 |   .0732426   .0867141     0.84   0.398    -.0967139    .2431991
       _cons |  -1.315206   1.220947    -1.08   0.281    -3.708217    1.077805
------------------------------------------------------------------------------

. gologit2 y x1 x2 x3 x4, npl sto(gologit) link(p)

Generalized Ordered Probit Estimates              Number of obs     =        152
                                                  LR chi2(20)       =      62.94
                                                  Prob > chi2       =     0.0000
Log likelihood = -197.17374                       Pseudo R2         =     0.1376

------------------------------------------------------------------------------
           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
0            |
          x1 |   .3572168   .4029218     0.89   0.375    -.4324953    1.146929
          x2 |  -.8430554   .5215851    -1.62   0.106    -1.865344    .1792327
          x3 |   .2174726   .4699002     0.46   0.644    -.7035149     1.13846
          x4 |   .6301649   .2667108     2.36   0.018     .1074213    1.152909
       _cons |  -7.270173   3.882206    -1.87   0.061    -14.87916    .3388114
-------------+----------------------------------------------------------------
1            |
          x1 |   .3815073   .3018235     1.26   0.206     -.210056    .9730705
          x2 |  -.0159532   .3528003    -0.05   0.964    -.7074291    .6755227
          x3 |  -.4463186    .318717    -1.40   0.161    -1.070992    .1783554
          x4 |  -.3245584   .1577207    -2.06   0.040    -.6336852   -.0154316
       _cons |   5.945013   2.271297     2.62   0.009     1.493353    10.39667
-------------+----------------------------------------------------------------
2            |
          x1 |   .3404404   .2758877     1.23   0.217    -.2002895    .8811702
          x2 |   .0353617   .3074022     0.12   0.908    -.5671356     .637859
          x3 |  -.0702493   .2585965    -0.27   0.786     -.577089    .4365905
```

```
          x4 |  -.1951006   .1263031    -1.54   0.122    -.4426502    .0524489
       _cons |   3.376936   1.791931     1.88   0.059    -.1351848    6.889057
-------------+----------------------------------------------------------------
3            |
          x1 |   1.140714   .2586096     4.41   0.000     .6338481    1.647579
          x2 |  -.6973459   .2627334    -2.65   0.008    -1.212294   -.1823979
          x3 |  -.0515296   .2426607    -0.21   0.832    -.5271359    .4240766
          x4 |  -.0319761   .1198625    -0.27   0.790    -.2669022      .20295
       _cons |   .6640111   1.677911     0.40   0.692    -2.624635    3.952657
-------------+----------------------------------------------------------------
4            |
          x1 |   .7732183   .2551915     3.03   0.002     .2730522    1.273384
          x2 |  -.6291826    .243014    -2.59   0.010    -1.105481   -.1528838
          x3 |   .4068852   .2489172     1.63   0.102    -.0809836    .8947539
          x4 |   .1212267   .1142629     1.06   0.289    -.1027244    .3451778
       _cons |  -2.159693   1.595193    -1.35   0.176    -5.286213    .9668279
------------------------------------------------------------------------------

WARNING! 86 in-sample cases have an outcome with a predicted probability that is
less than 0. See the gologit2 help section on Warning Messages for more information
> .

. lrtest ologit gologit, stats

Likelihood-ratio test                                 LR chi2(16) =     39.44
(Assumption: ologit nested in gologit)                Prob > chi2 =    0.0009

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
      ologit |        152 -228.6436  -216.8951       9    451.7902   479.0051
     gologit |        152 -228.6436  -197.1737      25    444.3475   519.9445
-----------------------------------------------------------------------------
               Note: N=Obs used in calculating BIC; see [R] BIC note.
```

From the order logit test we reject the H0: , which mean that the **appropriated model is MN logit** over ordered logit.

4. Compute marginal effect at mean and median of both models.

For MN Logit model

```
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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(0)) at((median))
```

```
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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(1)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
```

```
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(2)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(3)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(4)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   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
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(5))

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

Expression   : Pr(y==5), predict(outcome(5))
dy/dx w.r.t. : x1 x2 x3 x4

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |   .2487651   .0737675     3.37   0.001     .1041835    .3933467
          x2 |  -.1730834   .0790483    -2.19   0.029    -.3280153   -.0181515
          x3 |   .1175473   .0846921     1.39   0.165    -.0484461    .2835406
          x4 |   .0311825   .0375786     0.83   0.407    -.0424701    .1048351
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(5)) at((median))

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

Expression   : Pr(y==5), predict(outcome(5))
dy/dx w.r.t. : x1 x2 x3 x4

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |   .2487651   .0737675     3.37   0.001     .1041835    .3933467
          x2 |  -.1730834   .0790483    -2.19   0.029    -.3280153   -.0181515
          x3 |   .1175473   .0846921     1.39   0.165    -.0484461    .2835406
          x4 |   .0311825   .0375786     0.83   0.407    -.0424701    .1048351
------------------------------------------------------------------------------
```

For Ologit model

```
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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0681609   .0273944    -2.49   0.013     -.121853   -.0144688
          x2 |   .0461206   .0233188     1.98   0.048     .0004166    .0918247
          x3 |  -.0111831   .0186422    -0.60   0.549    -.0477211    .0253549
          x4 |   -.006818   .0084411    -0.81   0.419    -.0233623    .0097263
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(0)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0681609   .0273944    -2.49   0.013     -.121853   -.0144688
          x2 |   .0461206   .0233188     1.98   0.048     .0004166    .0918247
          x3 |  -.0111831   .0186422    -0.60   0.549    -.0477211    .0253549
          x4 |   -.006818   .0084411    -0.81   0.419    -.0233623    .0097263
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0599322   .0226362    -2.65   0.008    -.1042983    -.015566
          x2 |   .0405527   .0197166     2.06   0.040     .0019088    .0791965
          x3 |   -.009833   .0162697    -0.60   0.546     -.041721     .022055
          x4 |  -.0059949   .0073186    -0.82   0.413    -.0203391    .0083493
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(1)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
```

```
          x1 |  -.0599322   .0226362    -2.65   0.008    -.1042983    -.015566
          x2 |   .0405527   .0197166     2.06   0.040     .0019088    .0791965
          x3 |   -.009833   .0162697    -0.60   0.546     -.041721     .022055
          x4 |  -.0059949   .0073186    -0.82   0.413    -.0203391    .0083493
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0614076   .0202331    -3.04   0.002    -.1010639   -.0217514
          x2 |   .0415511   .0188187     2.21   0.027      .004667    .0784351
          x3 |  -.0100751   .0166518    -0.61   0.545    -.0427121    .0225619
          x4 |  -.0061425    .007391    -0.83   0.406    -.0206285    .0083435
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(2)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0614076   .0202331    -3.04   0.002    -.1010639   -.0217514
          x2 |   .0415511   .0188187     2.21   0.027      .004667    .0784351
          x3 |  -.0100751   .0166518    -0.61   0.545    -.0427121    .0225619
          x4 |  -.0061425    .007391    -0.83   0.406    -.0206285    .0083435
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0649197   .0193261    -3.36   0.001    -.1027982   -.0270412
          x2 |   .0439275   .0192343     2.28   0.022      .006229     .081626
          x3 |  -.0106513    .017627    -0.60   0.546    -.0451996    .0238969
          x4 |  -.0064938   .0078483    -0.83   0.408    -.0218763    .0088886
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(3)) at((median))

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
```

```
------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0649197   .0193261    -3.36   0.001    -.1027982   -.0270412
          x2 |   .0439275   .0192343     2.28   0.022     .006229     .081626
          x3 |  -.0106513    .017627    -0.60   0.546    -.0451996    .0238969
          x4 |  -.0064938   .0078483    -0.83   0.408    -.0218763    .0088886
------------------------------------------------------------------------------

. 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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0206373   .0127601    -1.62   0.106    -.0456467     .004372
          x2 |   .0139641   .0092144     1.52   0.130    -.0040958     .032024
          x3 |   -.003386   .0059659    -0.57   0.570    -.0150789     .008307
          x4 |  -.0020643   .0027613    -0.75   0.455    -.0074764    .0033478
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(4)) at((median))

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

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |  -.0206373   .0127601    -1.62   0.106    -.0456467     .004372
          x2 |   .0139641   .0092144     1.52   0.130    -.0040958     .032024
          x3 |   -.003386   .0059659    -0.57   0.570    -.0150789     .008307
          x4 |  -.0020643   .0027613    -0.75   0.455    -.0074764    .0033478
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(5))

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

Expression   : Pr(y==5), predict(outcome(5))
dy/dx w.r.t. : x1 x2 x3 x4

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          x1 |   .2750578   .0661191     4.16   0.000     .1454667    .4046489
          x2 |  -.1861159   .0724194    -2.57   0.010    -.3280553   -.0441766
          x3 |   .0451285    .073977     0.61   0.542    -.0998638    .1901208
          x4 |   .0275136    .032782     0.84   0.401    -.0367379    .0917651
------------------------------------------------------------------------------

. margins, dydx(*) predict(outcome(5)) at((median))

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

```
Expression   : Pr(y==5), predict(outcome(5))
dy/dx w.r.t. : x1 x2 x3 x4
```

	Delta-method				
	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]
x1	.2750578	.0661191	4.16	0.000	.1454667 .4046489
x2	-.1861159	.0724194	-2.57	0.010	-.3280553 -.0441766
x3	.0451285	.073977	0.61	0.542	-.0998638 .1901208
x4	.0275136	.032782	0.84	0.401	-.0367379 .0917651