**DATA SCIENCE (UPC). COURSE 21-22 Q1 – LABORATORY FINAL EXAM**

**STATISTICAL MODELLING AND INFERENCE.**

**(Date: 10/JAN/2022 15:00-18:00 h Place: Room A6002)**

## **Lecturer**: Lídia Montero Mercadé

## **Office:** Edifici C5 D207

## **Norms:** Calculator, statistical tables and R Studio reference documents included in ATENEA are allowed. Chatting is strictly forbidden. Mobile phones should be switched off.

## **Quiz duration:** 3h

## **Date for posting marks:** Before January 17th 2021, to be posted at Subject’s ATENEA WEB page.

## **Open-office:** Ask by email (day-time TBD)

**Problem 1: All qüestions account for 1 point**

A study of political ideology and the relationship to sociocultural characterization of U.S. individuals based on a survey from 944 observations in 10 variables from the 1996 General Social Survey is addressed. Data help quantify well-known relationships between income, age, education, and political affiliation. FPID political affiliation, response variable, is coded into three categories: Democrat, Independent, and Republican. The explanatory variables considered throughout the exercise are: income (factor and covariant), age and education (factor).

|  |  |
| --- | --- |
| **Variable** | **Definition** |
| **popul** | population of respondent's location in 1000s of people |
| **TVnews** | days in the past week spent watching news on TV |
| **selfLR** | Left-Right self-placement of respondent: an ordered factor with levels extremely liberal, extLib < liberal, Lib < slightly liberal, sliLib < moderate, Mod < slightly conservative, sliCon < conservative, Con < extremely conservative, extCon |
| **ClinLR** | Left-Right placement of Bill Clinton (same scale as selfLR): an ordered factor with levels extLib < Lib < sliLib < Mod < sliCon < Con < extCon |
| **DoleLR** | Left-Right placement of Bob Dole (same scale as selfLR): an ordered factor with levels extLib < Lib < sliLib < Mod < sliCon < Con < extCon |
| **PID** | Party identification: an ordered factor with levels strong Democrat, strDem < weak Democrat, weakDem < independent Democrat, indDem < independent independentindind < indepedent Republican, indRep < waek Republican, weakRep < strong Republican, strRep |
| **age** | Respondent's age in years |
| **educ** | Respondent's education: an ordered factor with levels 8 years or less, MS < high school dropout, HSdrop < high school diploma or GED, HS < some College, Coll < Community or junior College degree, CCdeg < BA degree, BAdeg < postgraduate degree, MAdeg |
| **income** | Respondent's family income: an ordered factor with 24 levels $3Kminus < $3K-$5K < $5K-$7K < $7K-$9K < $9K-$10K < $10K-$11K < $11K-$12K < $12K-$13K < $13K-$14K < $14K-$15K < $15K-$17K < $17K-$20K < $20K-$22K < $22K-$25K < $25K-$30K < $30K-$35K < $35K-$40K < $40K-$45K < $45K-$50K < $50K-$60K < $60K-$75K < $75K-$90K < $90K-$105K < $105Kplus |
| **vote** | Expected vote in 1996 presidential election: a factor with levels Clinton and Dole |
| **nincome** | Numerical income (1000$ dollars) – New variable defined for this exam as a covariant (mid point chosen for each interval) |
| **FPID** | Political: Democratic, Independent i Republican – Target – New variable defined for this exam |

**Source:**

Sapiro, Virginia, Steven J. Rosenstone, Donald R. Kinder, Warren E. Miller, and the National Election Studies. AMERICAN NATIONAL ELECTION STUDIES, 1992-1997: COMBINED FILE [Computer file]. 2nd ICPSR version. Ann Arbor, MI: University of Michigan, Center for Political Studies [producer], 1999. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 1999.

**References**

Found at <http://www.stat.washington.edu/>

**> summary(nes96)**

**popul TVnews selfLR ClinLR DoleLR PID**

**Min. : 0.0 Min. :0.000 extLib: 16 extLib:109 extLib: 13 strDem :200**

**1st Qu.: 1.0 1st Qu.:1.000 Lib :103 Lib :317 Lib : 31 weakDem:180**

**Median : 22.0 Median :3.000 sliLib:147 sliLib:236 sliLib: 43 indDem :108**

**Mean : 306.4 Mean :3.728 Mod :256 Mod :160 Mod : 87 indind : 37**

**3rd Qu.: 110.0 3rd Qu.:7.000 sliCon:170 sliCon: 67 sliCon:195 indRep : 94**

**Max. :7300.0 Max. :7.000 Con :218 Con : 36 Con :460 weakRep:150**

**extCon: 34 extCon: 19 extCon:115 strRep :175**

**age educ income vote FPID nincome**

**Min. :19.00 MS : 13 $60K-$75K:103 Clinton:551 Democratic :380 Min. : 1.50**

**1st Qu.:34.00 HSdrop: 52 $50K-$60K:100 Dole :393 Independent:239 1st Qu.: 23.50**

**Median :44.00 HS :248 $30K-$35K: 70 Republican :325 Median : 37.50**

**Mean :47.04 Coll :187 $25K-$30K: 68 Mean : 46.58**

**3rd Qu.:58.00 CCdeg : 90 $105Kplus: 68 3rd Qu.: 67.50**

**Max. :91.00 BAdeg :227 $35K-$40K: 62 Max. :115.00**

**MAdeg :127 (Other) :473**

**The first attempt is a nominal multinomial treatment for FPID target. Answer the questions accurately based on the contents presented in the course and the indicated results of specific models.**

1. Determine whether the gross effect of the income covariate is statistically significant or not. Determine if the gross effect of the income covariate is linear on the logodds scales.
2. Determine if the gross effect of the income factor is significant at the 0.05 significance level.
3. Calculate McFadden pseudo coefficient of determination for the model that facilitates the best treatment for the gross income/nincome effect.
4. Once income is in the model, as a covariant, determine if the net effect of age is statistically significant? Once income and age are in the model, determine if the net effect of education is statistically significant?
5. Determine which of the available proposals is most successful. Determine if the selected model fits well to data.
6. Interpret the effect of income on logodds and odds scales in the best model available so far.
7. Calculate estimates for the model parameters in the null multinomial model.
8. Calculate the predicted probabilities for the 3 ideologies in 40-year-old women with no education and median income using the best model available so far.
9. Evaluate the predictive power of the model with the chosen nominal response and the improvement over the null model.

**The second attempt is based on hierarchical logit modelling. A first level defines a binary logit model with a positive response from Other (non-Democratic) and a second level where non-Democratic units are discriminated between Republican (positive response) and Independent. Answer the questions accurately based on the content presented in the course and available results.**

1. Determine whether the gross effect of income is statistically significant? Which would be the best treatment for income in HL1?
2. Calculate a 95% confidence interval for the effect of the median range income level factor on the "Democratic" political affiliation odds. Use the mb1.2 model and interpret median income level in log-odds, odds and probability scales.
3. Interpret the effect of the covariate income on the scale of the odds involved. Use the mb1.1 and mb2.1 models. Assess whether the proposed mb1.1 and mb2.1 models fit well with data.
4. Calculate the predicted probabilities for the 3 ideologies in 40-year-old women with no education and median income. Use the mb1.1 and mb2.1 models.
5. Determine the estimated parameters for HL1 and HL2 **probit** **null models**.

**The third attempt is the proportional odds modelling, estimated from the point of view of latent variable in R. Answer the questions accurately based on the contents presented in the subject and the indicated results of specific models.**

1. Determine which of the available proposals for proportional odds modelling is most successful. Assess whether the proposed model fits well with the data.
2. Interpret the effect of the income covariate on the scale of proportional odds for om1 model.
3. Calculate the predicted probabilities for the 3 ideologies in 40-year-old women with no education and median income for om11 model.
4. Assess the predictive power of the chosen model in the output using ordinal response and the improvement over the null model.
5. Determine the estimated zeta (cut-off) points for the null model in the ordinal proposal when logit and probit link functions are stated.
6. Which of the 3 proposals, nominal multinomial, hierarchical logit or proportional logodds, is the most satisfactory?

**> options(contrasts=c("contr.treatment","contr.treatment"))**

**> summary(nes96)**

**popul TVnews selfLR ClinLR DoleLR PID age**

**Min. : 0.0 Min. :0.000 extLib: 16 extLib:109 extLib: 13 strDem :200 Min. :19.00**

**1st Qu.: 1.0 1st Qu.:1.000 Lib :103 Lib :317 Lib : 31 weakDem:180 1st Qu.:34.00**

**Median : 22.0 Median :3.000 sliLib:147 sliLib:236 sliLib: 43 indDem :108 Median :44.00**

**Mean : 306.4 Mean :3.728 Mod :256 Mod :160 Mod : 87 indind : 37 Mean :47.04**

**3rd Qu.: 110.0 3rd Qu.:7.000 sliCon:170 sliCon: 67 sliCon:195 indRep : 94 3rd Qu.:58.00**

**Max. :7300.0 Max. :7.000 Con :218 Con : 36 Con :460 weakRep:150 Max. :91.00**

**extCon: 34 extCon: 19 extCon:115 strRep :175**

**educ income vote nincome FPID BPID**

**MS : 13 $60K-$75K:103 Clinton:551 Min. : 1.50 Democratic :380 Democratic :380**

**HSdrop: 52 $50K-$60K:100 Dole :393 1st Qu.: 23.50 Independent:239 Other :564**

**HS :248 $30K-$35K: 70 Median : 37.50 Republican :325**

**Coll :187 $25K-$30K: 68 Mean : 46.58**

**CCdeg : 90 $105Kplus: 68 3rd Qu.: 67.50**

**BAdeg :227 $35K-$40K: 62 Max. :115.00**

**MAdeg :127 (Other) :473**

**> dim(nes96)**

**[1] 944 13**

**> prop.table(table(nes96$FPID))**

**Democratic Independent Republican**

**0.4025424 0.2531780 0.3442797**

**> summary(fit.0)**

**Call: multinom(formula = FPID ~ 1, data = nes96)**

**Coefficients:**

**(Intercept)**

**Independent -0.4636807**

**Republicà -0.1563643**

**Std. Errors:**

**(Intercept)**

**Independent 0.08255647**

**Republicà 0.07555502**

**Residual Deviance: 2041.272**

**AIC: 2045.272**

**> summary(fit.1)**

**Call:**

**multinom(formula = FPID ~ I(nincome - 37.5), data = nes96)**

**Coefficients:**

**(Intercept) I(nincome - 37.5)**

**Independent -0.5716824 0.01608684**

**Republicà -0.2879428 0.01766452**

**Std. Errors:**

**(Intercept) I(nincome - 37.5)**

**Independent 0.08744296 0.002849736**

**Republicà 0.08036775 0.002652530**

**Residual Deviance: 1985.424**

**AIC: 1993.424**

**> summary(fit.11)**

**Call:**

**multinom(formula = FPID ~ I(nincome - 37.5) + I((nincome - 37.5)^2),**

**data = nes96)**

**Coefficients:**

**(Intercept) I(nincome - 37.5) I((nincome - 37.5)^2)**

**Independent -0.5979774 0.01358562 4.585216e-05**

**Republicà -0.2328768 0.02174707 -9.642913e-05**

**Std. Errors:**

**(Intercept) I(nincome - 37.5) I((nincome - 37.5)^2)**

**Independent 0.10431903 0.004211187 8.333208e-05**

**Republicà 0.09454582 0.004014250 7.960309e-05**

**Residual Deviance: 1982.12**

**AIC: 1994.12**

**> summary(fit.2)**

**Call: multinom(formula = FPID ~ income, data = nes96)**

**Coefficients:**

**…**

**Std. Errors:**

**(Intercept) income$3K-$5K income$5K-$7K income$7K-$9K income$9K-$10K**

**…**

**Residual Deviance: 1932.417**

**AIC: 2028.417**

**> anova(fit.1,fit.11)**

**Likelihood ratio tests of Multinomial Models**

**Response: FPID**

**Model Resid. df Resid. Dev Test Df LR stat. Pr(Chi)**

**1 I(nincome - 37.5) 1884 1985.424**

**2 I(nincome - 37.5) + I((nincome - 37.5)^2) 1882 1982.120 1 vs 2 2 3.304235 0.1916437**

**> anova(fit.4,fit.5,test="Chisq")**

**Likelihood ratio tests of Multinomial Models**

**Response: FPID**

**Model Resid. df Resid. Dev Test Df LR stat.**

**1 I(nincome - 37.5) + I(age - 44) 1882 1984.539**

**2 I(nincome - 37.5) + I(age - 44) + I((age - 44)^2) 1880 1979.787 1 vs 2 2 4.751512**

**Pr(Chi)**

**1**

**2 0.09294419**

**> anova(fit.1,fit.5,test="Chisq")**

**Likelihood ratio tests of Multinomial Models**

**Response: FPID**

**Model Resid. df Resid. Dev Test Df LR stat.**

**1 I(nincome - 37.5) 1884 1985.424**

**2 I(nincome - 37.5) + I(age - 44) + I((age - 44)^2) 1880 1979.787 1 vs 2 4 5.636848**

**Pr(Chi)**

**1**

**2 0.2279597**

**> step(fit.6)**

**Start: AIC=2030.34**

**FPID ~ (I(nincome - 37.5) + I(age - 44) + I((age - 44)^2)) \* educ**

**... SOME LINES HAVE BEEN REMOVED**

**Df AIC**

**Call:**

**multinom(formula = FPID ~ I(nincome - 37.5) + I((age - 44)^2),**

**data = nes96)**

**Coefficients:**

**(Intercept) I(nincome - 37.5) I((age - 44)^2)**

**Independent -0.6636446 0.01726637 0.0003050779**

**Republicà -0.4241696 0.01931352 0.0004399041**

**Residual Deviance: 1980.881**

**AIC: 1992.881**

**>**

**> step(fit.7)**

**Start: AIC=2003.63**

**FPID ~ I(nincome - 37.5) + educ**

**... SOME LINES HAVE BEEN REMOVED**

**Call:**

**multinom(formula = FPID ~ I(nincome - 37.5), data = nes96)**

**Coefficients:**

**(Intercept) I(nincome - 37.5)**

**Independent -0.5716824 0.01608684**

**Republicà -0.2879428 0.01766452**

**Residual Deviance: 1985.424**

**AIC: 1993.424**

**> pmprob1 <- predict(fit.1,type="class")**

**> pmprob0 <- predict(fit.0,type="class")**

**> table(pmprob1,nes96$FPID);table(pmprob0,nes96$FPID)**

**pmprob1 Democrata Independent Republicà**

**Democrata 284 123 166**

**Independent 0 0 0**

**Republicà 96 116 159**

**pmprob0 Democrata Independent Republicà**

**Democrata 380 239 325**

**Independent 0 0 0**

**Republicà 0 0 0**

**> summary(mb1.0)**

**Call:**

**glm(formula = BPID ~ 1, family = binomial(link = "logit"), data = nes96)**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) 0.39488 0.06637 5.95 2.68e-09 \*\*\***

**---**

**Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1**

**(Dispersion parameter for binomial family taken to be 1)**

**Null deviance: 1272.6 on 943 degrees of freedom**

**Residual deviance: 1272.6 on 943 degrees of freedom**

**AIC: 1274.6**

**> summary(mb1.1)**

**Call:**

**glm(formula = BPID ~ I(nincome - 37.5), family = binomial(link = "logit"),**

**data = nes96)**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) 0.273565 0.069362 3.944 8.01e-05 \*\*\***

**I(nincome - 37.5) 0.016997 0.002406 7.065 1.60e-12 \*\*\***

**---**

**Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1**

**(Dispersion parameter for binomial family taken to be 1)**

**Null deviance: 1272.6 on 943 degrees of freedom**

**Residual deviance: 1217.1 on 942 degrees of freedom**

**AIC: 1221.1**

**> summary(mb1.2)**

**Call: glm(formula = BPID ~ income, family = binomial(link = "logit"), data = nes96)**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) -0.77319 0.49355 -1.567 0.117209**

**….**

**income$25K-$30K 0.71435 0.54997 1.299 0.193980**

**income$30K-$35K 0.83035 0.54843 1.514 0.130016**

**income$35K-$40K 1.09861 0.55662 1.974 0.048415 \***

**income$40K-$45K 1.10966 0.57385 1.934 0.053148 .**

**income$45K-$50K 0.81241 0.56750 1.432 0.152266**

**…**

**---**

**Null deviance: 1272.6 on 943 degrees of freedom**

**Residual deviance: 1200.8 on 920 degrees of freedom**

**AIC: 1248.8**

**> summary(mb1.11)**

**Call: glm(formula = BPID ~ I(nincome - 37.5) + I((nincome - 37.5)^2), family = binomial(link = "logit"), data = nes96)**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) 2.960e-01 8.396e-02 3.525 0.000423 \*\*\***

**I(nincome - 37.5) 1.814e-02 3.406e-03 5.326 1e-07 \*\*\***

**I((nincome - 37.5)^2) -3.364e-05 7.053e-05 -0.477 0.633381**

**---**

**Null deviance: 1272.6 on 943 degrees of freedom**

**Residual deviance: 1216.8 on 941 degrees of freedom**

**AIC: 1222.8**

**> summary(mb2.1)**

**Call:**

**glm(formula = FPID ~ I(nincome - 37.5), family = binomial(link = "logit"),**

**data = nes96[nes96$FPID != "Democratic", ])**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) 0.283466 0.093931 3.018 0.00255 \*\***

**I(nincome - 37.5) 0.001596 0.002659 0.600 0.54838**

**---**

**Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1**

**(Dispersion parameter for binomial family taken to be 1)**

**Null deviance: 768.71 on 563 degrees of freedom**

**Residual deviance: 768.34 on 562 degrees of freedom**

**AIC: 772.34**

**Number of Fisher Scoring iterations: 4**

**> summary(mb2.11)**

**Call:**

**glm(formula = FPID ~ I(nincome - 37.5) + I((nincome - 37.5)^2),**

**family = binomial(link = "logit"), data = nes96[nes96$FPID !=**

**"Democratic", ])**

**Coefficients:**

**Estimate Std. Error z value Pr(>|z|)**

**(Intercept) 3.656e-01 1.056e-01 3.462 0.000536 \*\*\***

**I(nincome - 37.5) 7.973e-03 4.536e-03 1.758 0.078808 .**

**I((nincome - 37.5)^2) -1.405e-04 8.098e-05 -1.734 0.082840 .**

**---**

**Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1**

**(Dispersion parameter for binomial family taken to be 1)**

**Null deviance: 768.71 on 563 degrees of freedom**

**Residual deviance: 765.34 on 561 degrees of freedom**

**AIC: 771.34**

**Number of Fisher Scoring iterations: 4**

**> anova(mb2.1,mb2.11,test="Chisq")**

**Analysis of Deviance Table**

**Model 1: FPID ~ I(nincome - 37.5)**

**Model 2: FPID ~ I(nincome - 37.5) + I((nincome - 37.5)^2)**

**Resid. Df Resid. Dev Df Deviance P(>|Chi|)**

**1 562 768.34**

**2 561 765.34 1 3.01 0.08**

**> step(mb1.3)**

**Start: AIC=1245.02**

**BPID ~ (I(nincome - 37.5) + I((age - 44)) + I((age - 44)^2)) \* educ**

**...**

**glm(formula = BPID ~ I(nincome - 37.5) + I((age - 44)^2), family = binomial(link = "logit"), data = nes96)**

**Coefficients:**

**(Intercept) I(nincome - 37.5) I((age - 44)^2)**

**0.1562550 0.0184453 0.0003833**

**Degrees of Freedom: 943 Total (i.e. Null); 941 Residual**

**Null Deviance: 1273**

**Residual Deviance: 1213 AIC: 1219**

**> step(mb2.3)**

**Start: AIC=793.85**

**FPID ~ (I(nincome - 37.5) + I((nincome - 37.5)^2) + I((age -**

**44)) + I((age - 44)^2)) \* educ**

**...**

**glm(formula = FPID ~ I((age - 44)^2) + educ + I((age - 44)^2):educ, family = binomial(link = "logit"), data = nes96[nes96$FPID != "Democrata", ])**

**Null Deviance: 768.7**

**Residual Deviance: 741.9 AIC: 769.9**

**> mb1.1$deviance;mb1.1$df.residual**

**[1] 1217.076**

**[1] 942**

**> mb2.1$deviance;mb2.1$df.residual**

**[1] 768.3443**

**[1] 562**

**> library(ResourceSelection)**

**> res.hltest1<-hoslem.test(nes96$BPID, fitted(mb1.1));res.hltest1**

**Hosmer and Lemeshow goodness of fit (GOF) test**

**data: nes96$BPID, fitted(mb1.1)**

**X-squared = 944, df = 8, p-value < 2.2e-16**

**> res.hltest2<-hoslem.test(nes96$FPID[nes96$FPID != "Democratic"], fitted(mb2.1));res.hltest2**

**Hosmer and Lemeshow goodness of fit (GOF) test**

**data: nes96$FPID[nes96$FPID != "Democratic"], fitted(mb2.1)**

**X-squared = 564, df = 8, p-value < 2.2e-16**

**> AIC(om1)**

**[1] 2001.363**

**> anova(om1,om11,test="Chisq")**

**Likelihood ratio tests of ordinal regression models**

**Response: FPID**

**Model Resid. df Resid. Dev Test Df LR stat. Pr(Chi)**

**1 I(nincome - 37.5) 941 1995.363**

**2 I(nincome - 37.5) + I((nincome - 37.5)^2) 940 1991.956 1 vs 2 1 3.406832 0.06492698**

**> anova(om0,om1,test="Chisq")**

**Likelihood ratio tests of ordinal regression models**

**Response: FPID**

**Model Resid. df Resid. Dev Test Df LR stat. Pr(Chi)**

**1 1 942 2041.272**

**2 I(nincome - 37.5) 941 1995.363 1 vs 2 1 45.90949 1.238443e-11**

**> summary(om1)**

**Call: polr(formula = FPID ~ I(nincome - 37.5), data = nes96)**

**Coefficients:**

**Value Std. Error t value**

**I(nincome - 37.5) 0.01312 0.00197 6.659**

**Intercepts:**

**Value Std. Error t value**

**Democratic|Independent -0.2829 0.0693 -4.0826**

**Independent|Republican 0.7996 0.0737 10.8517**

**Residual Deviance: 1995.363**

**AIC: 2001.363**

**> summary(om11)**

**Call:**

**polr(formula = FPID ~ I(nincome - 37.5) + I((nincome - 37.5)^2),**

**data = nes96)**

**Coefficients:**

**Value Std. Error t value**

**I(nincome - 37.5) 0.0175727779 0.0042283667 4.1559257**

**I((nincome - 37.5)^2) -0.0001080393 0.0001286093 -0.8400588**

**Intercepts:**

**Value Std. Error t value**

**Democrata|Independent -0.3557 0.1034 -3.4386**

**Independent|Republicà 0.7299 0.1034 7.0561**

**Residual Deviance: 1991.956**

**AIC: 1999.956**

**> summary(om2)**

**Call:**

**polr(formula = FPID ~ income, data = nes96)**

**Coefficients:**

**Value Std. Error t value**

**…**

**income$30K-$35K 1.04404 0.5408 1.93064**

**income$35K-$40K 1.14254 0.5426 2.10554**

**income$40K-$45K 1.10373 0.5565 1.98343**

**income$45K-$50K 0.88261 0.5561 1.58704**

**…**

**Intercepts:**

**Value Std. Error t value**

**Democratic|Independent 0.7380 0.4873 1.5145**

**Independent|Republican 1.8345 0.4901 3.7432**

**Residual Deviance: 1980.027**

**AIC: 2030.027**

**> poprobx <- predict(om2,type="class")**

**> poprob0 <- predict(om0,type="class")**

**> table(poprobx,nes96$FPID);table(poprob0,nes96$FPID)**

**poprobx Democrata Independent Republicà**

**Democrata 284 123 166**

**Independent 0 0 0**

**Republicà 96 116 159**

**poprob0 Democrata Independent Republicà**

**Democrata 380 239 325**

**Independent 0 0 0**

**Republicà 0 0 0**

**>**

**> summary(fit.2)**

**Call: multinom(formula = FPID ~ income, data = nes96)**

**Coefficients:**

**…**

**Std. Errors:**

**(Intercept) income$3K-$5K income$5K-$7K income$7K-$9K income$9K-$10K**

**…**

**Residual Deviance: 1932.417**

**AIC: 2028.417**