MA678 homework 05

Multinomial Regression

Your Name

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Happiness

Data were collected from 39 students in a University of Chicago MBA class and may be found in the dataset `happy`.

1. Build a model for the level of happiness as a function of the other variables.

```
## Call:
## polr(formula = factor(happy) ~ money + factor(sex) + factor(love) +
##     factor(work), data = data, weights = n)
##
## Coefficients:
##                   Value Std. Error   t value
## money           0.01783    0.01087  1.640269
## factor(sex)1   -1.02504    0.93628 -1.094799
## factor(love)2   3.45763    1.56121  2.214710
## factor(love)3   7.85032    1.85199  4.238856
## factor(work)2  -1.18913    1.68764 -0.704613
## factor(work)3   0.01566    1.58055  0.009908
## factor(work)4   1.84616    1.53694  1.201193
## factor(work)5   0.64759    2.14981  0.301232
##
## Intercepts:
##       Value   Std. Error t value
## 2|3   -0.8388  1.8386    -0.4562
## 3|4    0.0101  1.7713     0.0057
## 4|5    2.4280  2.0149     1.2050
## 5|6    4.4745  2.1063     2.1243
## 6|7    5.0675  2.1242     2.3855
## 7|8    7.3972  2.2302     3.3168
## 8|9   11.3103  2.5925     4.3628
## 9|10 13.0848  2.7916     4.6872
##
## Residual Deviance: 90.47841
## AIC: 122.4784
```

2. Interpret the parameters of your chosen model.

Because the responding variable is treated as ordinal, so the cumulative model can be interpreted as the distribution of Y, which is

$$P(Y > y_i) = logit^{-1}(X\beta_i)$$

We can also interpret it as odds, which is:

$$\log \frac{P(Y > y_i)}{P(Y \leqslant y_i)} = X\beta$$

- $\log \frac{P(Y=3,\ldots,10)}{P(Y=2)} = -0.8388 + X\beta$
- $\log \frac{P(Y=4,\ldots,10)}{P(Y=3)} = 0.0101 + X\beta$
- $\log \frac{P(Y=5,\ldots,10)}{P(Y=4)} = 2.4280 + X\beta$
- $\ldots$

3. Predict the happiness distribution for subject whose parents earn $30,000 a year, who is lonely, not sexually active and has no job.

x
0.2020282
0.1697189
0.4973656
0.1118034
0.0084461
0.0095925
0.0010244
0.0000174
0.0000035