Mock Exam

Exercise 1

```
library(ltm)

## Loading required package:  MASS
## Loading required package:  msm
## Loading required package:  polycor

cheating <- read.table("cheating.txt")

dsc <- descript(cheating)
dsc$perc

##                   0          1     logit
## LIEEXAM  0.8934169 0.10658307 -2.126129
## LIEPAPER 0.8808777 0.11912226 -2.000769
## FRAUD    0.9341693 0.06583072 -2.652571
## COPYEXAM 0.7868339 0.21316614 -1.305945

dsc$items

##        0  1  2 3 4
## Freq 207 76 25 9 2

dsc$pw.ass

##   Item i Item j p.value
## 1      2      4   0.151
## 2      1      4   0.150
## 3      2      3   0.037
## 4      1      3   0.025
## 5      3      4   0.002
## 6      1      2   0.001

m1.rip <- ltm(cheating ~ z1, IRT.param = FALSE)

summary(m1.rip)

##
## Call:
## ltm(formula = cheating ~ z1, IRT.param = FALSE)
##
## Model Summary:
##  log.Lik      AIC      BIC
##  -440.23 896.4599 926.5815
##
## Coefficients:
##                         value std.err  z.vals
## (Intercept).LIEEXAM  -4.4732  1.9143 -2.3368
## (Intercept).LIEPAPER -3.6944  1.1547 -3.1994
## (Intercept).FRAUD    -3.0801  0.3725 -8.2678
## (Intercept).COPYEXAM -1.3791  0.1556 -8.8660
## z1.LIEEXAM            3.1164  1.7328  1.7984
```

```
## z1.LIEPAPER           2.5815  1.1390  2.2665
## z1.FRAUD              1.0279  0.3692  2.7839
## z1.COPYEXAM           0.5163  0.2282  2.2626
##
## Integration:
## method: Gauss-Hermite
## quadrature points: 21
##
## Optimization:
## Convergence: 0
## max(|grad|): 0.0076
## quasi-Newton: BFGS
```

```
alpha <- m1.rip$coefficients[,2]
alpha
```

```
##   LIEEXAM  LIEPAPER     FRAUD  COPYEXAM
## 3.1163675 2.5815212 1.0279310 0.5162571
```

```
stalpha <- alpha/sqrt(1+alpha^2)
stalpha
```

```
##   LIEEXAM  LIEPAPER     FRAUD  COPYEXAM
## 0.9521788 0.9324828 0.7167779 0.4587328
```

```
coef(m1.rip, prob = TRUE, order = TRUE)
```

```
##          (Intercept)        z1 P(x=1|z=0)
## LIEEXAM    -4.473222 3.1163675 0.01128176
## LIEPAPER   -3.694397 2.5815212 0.02425930
## FRAUD      -3.080135 1.0279310 0.04393416
## COPYEXAM   -1.379139 0.5162571 0.20114731
```

```
E <- fitted(m1.rip)[,5]
O <- m1.rip$patterns$obs
cbind(m1.rip$patterns$X, O, E)
```

```
##                  O           E
##  [1,] 0 0 0 0 207 205.6982523
##  [2,] 0 0 0 1  46  47.1411191
##  [3,] 0 0 1 0   7   9.1736797
##  [4,] 0 0 1 1   5   2.8187912
##  [5,] 0 1 0 0  13  12.5501381
##  [6,] 0 1 0 1   4   5.1930619
##  [7,] 0 1 1 0   1   1.6705821
##  [8,] 0 1 1 1   2   0.7982847
##  [9,] 1 0 0 0  10   9.6501979
## [10,] 1 0 0 1   3   4.3174125
## [11,] 1 0 1 0   1   1.4908193
## [12,] 1 0 1 1   2   0.7622705
## [13,] 1 1 0 0  11   8.2686623
## [14,] 1 1 0 1   4   5.1611361
## [15,] 1 1 1 0   1   2.4914920
## [16,] 1 1 1 1   2   1.8141004
```

```
Chisq <- sum((E-O)^2/E)
Chisq
```

```
## [1] 9.268555
```

```
DOF <- 16 - 4*2 -1
```

```
DOF
```

```
## [1] 7
```

```
pvalueC <- 1 - pchisq(Chisq, DOF)
pvalueC
```

```
## [1] 0.2339457
```

```
LR <- 2 * sum(O * log(O/E))
LR
```

```
## [1] 8.169943
```

```
pvalueLR <- 1 - pchisq(LR, DOF)
pvalueLR
```

```
## [1] 0.3178474
```

```
margins(m1.rip)
```

```
##
## Call:
## ltm(formula = cheating ~ z1, IRT.param = FALSE)
##
## Fit on the Two-Way Margins
##
## Response: (0,0)
##   Item i Item j Obs    Exp (O-E)^2/E
## 1      3      4 241 236.17      0.10
## 2      1      4 228 229.09      0.01
## 3      2      4 225 226.01      0.00
##
## Response: (1,0)
##   Item i Item j Obs   Exp (O-E)^2/E
## 1      3      4  10 14.83      1.57
## 2      1      4  23 21.90      0.06
## 3      2      4  26 24.98      0.04
##
## Response: (0,1)
##   Item i Item j Obs   Exp (O-E)^2/E
## 1      3      4  57 61.81      0.37
## 2      2      3  15 14.25      0.04
## 3      1      3  15 14.46      0.02
##
## Response: (1,1)
##   Item i Item j Obs   Exp (O-E)^2/E
## 1      3      4  11  6.19      3.73 ***
## 2      1      4  11 12.05      0.09
## 3      2      3   6  6.77      0.09
##
## '***' denotes a chi-squared residual greater than 3.5
```

```
fs <- factor.scores(m1.rip, method = "EAP")
resp.pattern <- fs$score.dat[,1:4]
total.score  <- apply(resp.pattern, 1, sum)
total.score
```

```
##  [1] 0 1 1 2 1 2 2 3 1 2 2 3 2 3 3 4
```

```
round(fs$score.dat[order(total.score),],3)
```

```
##    LIEEXAM LIEPAPER FRAUD COPYEXAM Obs     Exp     z1 se.z1
## 1        0        0     0        0 207 205.698 -0.354 0.836
## 2        0        0     0        1  46  47.141 -0.019 0.773
## 3        0        0     1        0   7   9.174  0.262 0.711
## 5        0        1     0        0  13  12.550  0.883 0.564
## 9        1        0     0        0  10   9.650  1.043 0.530
## 4        0        0     1        1   5   2.819  0.502 0.654
## 6        0        1     0        1   4   5.193  1.038 0.531
## 7        0        1     1        0   1   1.671  1.176 0.508
## 10       1        0     0        1   3   4.317  1.182 0.507
## 11       1        0     1        0   1   1.491  1.310 0.494
## 13       1        1     0        0  11   8.269  1.690 0.508
## 8        0        1     1        1   2   0.798  1.305 0.494
## 12       1        0     1        1   2   0.762  1.434 0.490
## 14       1        1     0        1   4   5.161  1.828 0.526
## 15       1        1     1        0   1   2.491  1.976 0.550
## 16       1        1     1        1   2   1.814  2.140 0.580
```