**1.**

We load the data, compute the covariance matrix, and we fit a CFA model with three correlated factors (one for each attitude concept), and assuming each item only has a loading on the concept it aims to measure. We print fit measures, the standardized solution and we compute, for each latent variable, the composite reliability, the average variance extracted and the maximum shared variance with other latent variables.

load("ess.Rdata")

ess <- ess[-1]

names(ess)[1:13]<-c("sotru1","sotru2","sotru3","truin1","truin2","truin3","truin4",

"webe1","webe2","webe3","webe4","webe5","webe6")

covmat<-cov(ess)

##specify model with 3 correlated factors

cfa1<-'sotru =~NA\*+sotru1+sotru2+sotru3

truin =~NA\*truin1+truin2+truin3+truin4

webe =~NA\*webe1+webe2+webe3+webe4+webe5+webe6

sotru ~~1\*sotru

truin ~~1\*truin

webe ~~1\*webe'

#fit model on covariance matrix

fitcfa1<-cfa(cfa1,sample.cov=covmat,sample.nobs=4046)

#print fit measures

> fitmeasures(fitcfa1,c("chisq","df","pvalue","cfi","tli","rmsea","srmr"))

chisq df pvalue cfi tli rmsea srmr

1526.049 62.000 0.000 0.912 0.889 0.076 0.040

> #standardized solution

> d<-standardizedSolution(fitcfa1)

> d

lhs op rhs est.std se z pvalue ci.lower ci.upper

1 sotru =~ sotru1 0.684 0.013 52.036 0 0.658 0.709

2 sotru =~ sotru2 0.648 0.013 48.322 0 0.622 0.674

3 sotru =~ sotru3 0.626 0.014 46.031 0 0.600 0.653

4 truin =~ truin1 0.789 0.008 93.956 0 0.773 0.805

5 truin =~ truin2 0.718 0.010 74.774 0 0.699 0.737

6 truin =~ truin3 0.581 0.012 48.194 0 0.557 0.605

7 truin =~ truin4 0.802 0.008 97.758 0 0.786 0.818

8 webe =~ webe1 0.661 0.011 60.710 0 0.640 0.683

9 webe =~ webe2 0.670 0.011 62.343 0 0.649 0.691

10 webe =~ webe3 0.589 0.012 48.379 0 0.565 0.612

11 webe =~ webe4 0.718 0.010 72.725 0 0.699 0.738

12 webe =~ webe5 0.677 0.011 63.729 0 0.656 0.698

13 webe =~ webe6 0.595 0.012 49.291 0 0.571 0.618

14 sotru ~~ sotru 1.000 0.000 NA NA 1.000 1.000

15 truin ~~ truin 1.000 0.000 NA NA 1.000 1.000

16 webe ~~ webe 1.000 0.000 NA NA 1.000 1.000

17 sotru1 ~~ sotru1 0.533 0.018 29.674 0 0.498 0.568

18 sotru2 ~~ sotru2 0.580 0.017 33.355 0 0.546 0.614

19 sotru3 ~~ sotru3 0.608 0.017 35.629 0 0.574 0.641

20 truin1 ~~ truin1 0.377 0.013 28.488 0 0.352 0.403

21 truin2 ~~ truin2 0.485 0.014 35.192 0 0.458 0.512

22 truin3 ~~ truin3 0.662 0.014 47.280 0 0.635 0.690

23 truin4 ~~ truin4 0.357 0.013 27.162 0 0.331 0.383

24 webe1 ~~ webe1 0.562 0.014 39.020 0 0.534 0.591

25 webe2 ~~ webe2 0.551 0.014 38.292 0 0.523 0.579

26 webe3 ~~ webe3 0.654 0.014 45.641 0 0.626 0.682

27 webe4 ~~ webe4 0.484 0.014 34.112 0 0.456 0.512

28 webe5 ~~ webe5 0.542 0.014 37.693 0 0.514 0.570

29 webe6 ~~ webe6 0.646 0.014 45.059 0 0.618 0.675

30 sotru ~~ truin 0.555 0.016 34.183 0 0.524 0.587

31 sotru ~~ webe 0.287 0.020 14.604 0 0.248 0.326

32 truin ~~ webe 0.185 0.018 10.022 0 0.149 0.221

> factorscore<-c("sotru","truin","webe")

> #composite reliability

> reliability<-round(c(compositerel(d[1:3,4]),compositerel(d[4:6,4]),compositerel(d[7:9,4])),3)

> #average variance extracted

> average\_var\_extracted<-round(c(mean(d[1:3,4]^2),mean(d[4:6,4]^2),mean(d[7:9,4]^2)),3)

> #maximum shared variance

> max\_shared\_var<-round(c(max(d[c(22,23),4]^2),max(d[c(22,24),4]^2),max(d[c(23,24),4]^2)),3)

> data.frame(factorscore,reliability,average\_var\_extracted,max\_shared\_var)

factorscore reliability average\_var\_extracted max\_shared\_var

1 sotru 0.690 0.427 0.439

2 truin 0.741 0.492 0.439

3 webe 0.756 0.510 0.316

The **fit measures** indicate that the model is rejected by an absolute goodness of fit test, i.e. the fit of the model is significantly lower than for a perfectly fitting model (chisquare= 1526.049, df=62, p<.001). Furthermore, descriptive fit measures also indicate that the model cannot reproduce the observed covariance matrix well: CFI (.912) and TLI (.889) both are lower than 0.95 and hence do not meet the cutoff of good fit. RMSEA (.076) indicates poor fit as it is below 0.08. Given these results, it is clear that further modifications to the model are needed.

As can be seen in the standardized solution, not all variables have significant? and positive standardized loadings that exceed 0.7. Hence, the individual variables have sufficient reliability and **convergent validity** is satisfied for the measurement model. Furthermore, **divergent validity** is satisfied as all latent variables have moderate correlations

that are significantly smaller than 1 (.555, .287, .185). Divergent validity is also confirmed using the criterion of Fornell and Lanker as we see that for, each latent variable, the average variance extracted in the observed indicator variables is larger than the maximum variance that is shared with other latent variables.

Finally, we see that composite reliability of the factor scores is not good as for all latent variables **composite reliabilities** are between 0.6 and 0.8.