HW

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```
df <- read.csv('security_data_sem.csv', header = T)
```

Question 1. Composite Path Models using PLS-PM

a. Create a PLS path model using SEMinR

- i. Measurement model – all constructs are measured as composites:

```
# Measurement Model

measurements1 <- constructs(
    composite("TRUST", multi_items("TRST", 1:4)),
    composite("SEC", multi_items("PSEC", 1:4)),
    composite("REP", multi_items("PREP", 1:4)),
    composite("INV", multi_items("PINV", 1:3)),
    composite("POL", multi_items("PPSS", 1:3)),
    composite("FAML", single_item("FAML1")),
    interaction_term(iv = "REP", moderator = "POL", method =  orthogonal))
```

- ii. Structural Model – paths between constructs as shown in this causal model:

```
structure1 <- relationships(
  paths(from = c("REP", "INV", "POL", "FAML",  "REP*POL"), to = "SEC"),
  paths(from = "SEC", to = "TRUST")
)
```

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b. Show us the following results in table or figure formats:

- i. Plot a figure of the estimated model

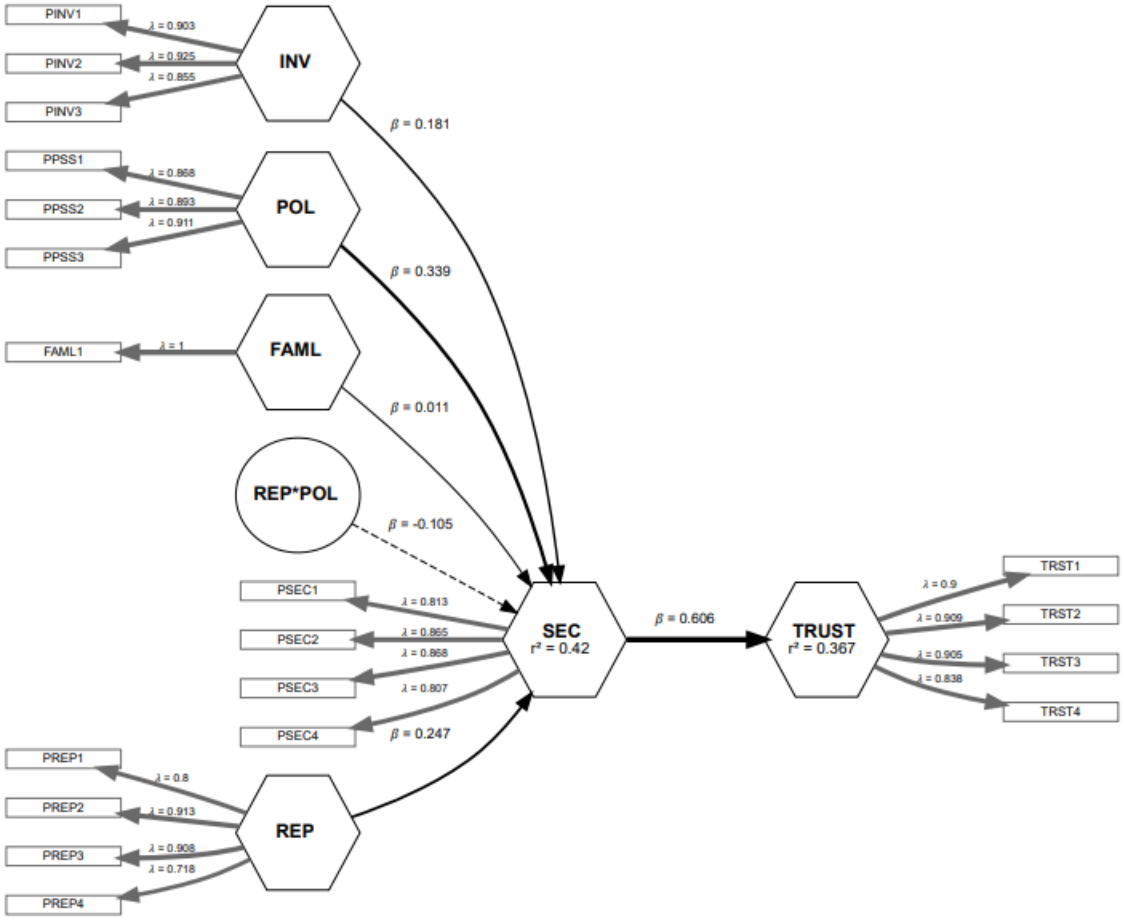
```
# Estimate using PLS-PM from model parts defined earlier

pls_model1 <- estimate_pls(data = df,
                           measurement_model = measurements1,
                           structural_model = structure1)

## Generating the seminr model

## All 405 observations are valid.

plot(pls_model1)
```



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ii. Weights and loadings of composites

```
report1 <-summary(pls_model1)
report1$weights
```

```
##                REP   INV   POL  FAML REP*POL   SEC TRUST
## TRST1        0.000 0.000 0.000 0.000   0.000 0.000 0.282
## TRST2        0.000 0.000 0.000 0.000   0.000 0.000 0.280
## TRST3        0.000 0.000 0.000 0.000   0.000 0.000 0.286
## TRST4        0.000 0.000 0.000 0.000   0.000 0.000 0.278
## PSEC1        0.000 0.000 0.000 0.000   0.000 0.277 0.000
## PSEC2        0.000 0.000 0.000 0.000   0.000 0.315 0.000
## PSEC3        0.000 0.000 0.000 0.000   0.000 0.307 0.000
## PSEC4        0.000 0.000 0.000 0.000   0.000 0.292 0.000
## PREP1        0.215 0.000 0.000 0.000   0.000 0.000 0.000
## PREP2        0.334 0.000 0.000 0.000   0.000 0.000 0.000
## PREP3        0.349 0.000 0.000 0.000   0.000 0.000 0.000
## PREP4        0.287 0.000 0.000 0.000   0.000 0.000 0.000
## PINV1        0.000 0.363 0.000 0.000   0.000 0.000 0.000
## PINV2        0.000 0.395 0.000 0.000   0.000 0.000 0.000
## PINV3        0.000 0.358 0.000 0.000   0.000 0.000 0.000
## PPSS1        0.000 0.000 0.360 0.000   0.000 0.000 0.000
## PPSS2        0.000 0.000 0.395 0.000   0.000 0.000 0.000
## PPSS3        0.000 0.000 0.367 0.000   0.000 0.000 0.000
## FAML1        0.000 0.000 0.000 1.000   0.000 0.000 0.000
## PREP1*PPSS1 0.000 0.000 0.000 0.000   0.239 0.000 0.000
## PREP1*PPSS2 0.000 0.000 0.000 0.000   0.031 0.000 0.000
## PREP1*PPSS3 0.000 0.000 0.000 0.000   0.021 0.000 0.000
## PREP2*PPSS1 0.000 0.000 0.000 0.000   0.046 0.000 0.000
## PREP2*PPSS2 0.000 0.000 0.000 0.000  -0.104 0.000 0.000
```

```
## PREP2*PPSS3 0.000 0.000 0.000 0.000  -0.228 0.000 0.000
## PREP3*PPSS1 0.000 0.000 0.000 0.000  -0.341 0.000 0.000
## PREP3*PPSS2 0.000 0.000 0.000 0.000   0.095 0.000 0.000
## PREP3*PPSS3 0.000 0.000 0.000 0.000   0.108 0.000 0.000
## PREP4*PPSS1 0.000 0.000 0.000 0.000   0.443 0.000 0.000
## PREP4*PPSS2 0.000 0.000 0.000 0.000   0.382 0.000 0.000
## PREP4*PPSS3 0.000 0.000 0.000 0.000   0.271 0.000 0.000
```

```
report1$loadings
```

```
##               REP    INV    POL   FAML REP*POL    SEC  TRUST
## TRST1       0.000  0.000  0.000  0.000  -0.000  0.000  0.900
## TRST2       0.000  0.000  0.000  0.000  -0.000  0.000  0.909
## TRST3       0.000  0.000  0.000  0.000  -0.000  0.000  0.905
## TRST4       0.000  0.000  0.000  0.000  -0.000  0.000  0.838
## PSEC1       0.000  0.000  0.000  0.000  -0.000  0.813  0.000
## PSEC2       0.000  0.000  0.000  0.000  -0.000  0.865  0.000
## PSEC3       0.000  0.000  0.000  0.000  -0.000  0.868  0.000
## PSEC4       0.000  0.000  0.000  0.000  -0.000  0.807  0.000
## PREP1       0.800  0.000  0.000  0.000   0.000  0.000  0.000
## PREP2       0.913  0.000  0.000  0.000   0.000  0.000  0.000
## PREP3       0.908  0.000  0.000  0.000   0.000  0.000  0.000
## PREP4       0.718  0.000  0.000  0.000   0.000  0.000  0.000
## PINV1       0.000  0.903  0.000  0.000  -0.000  0.000  0.000
## PINV2       0.000  0.925  0.000  0.000  -0.000  0.000  0.000
## PINV3       0.000  0.855  0.000  0.000  -0.000  0.000  0.000
## PPSS1       0.000  0.000  0.868  0.000   0.000  0.000  0.000
## PPSS2       0.000  0.000  0.893  0.000   0.000  0.000  0.000
## PPSS3       0.000  0.000  0.911  0.000   0.000  0.000  0.000
## FAML1       0.000  0.000  0.000  1.000  -0.000  0.000  0.000
## PREP1*PPSS1 -0.000 -0.000 -0.000 -0.000   0.581 -0.000 -0.000
## PREP1*PPSS2 -0.000 -0.000  0.000 -0.000   0.510 -0.000 -0.000
## PREP1*PPSS3 -0.000 -0.000 -0.000 -0.000   0.506 -0.000 -0.000
## PREP2*PPSS1 -0.000 -0.000 -0.000 -0.000   0.509 -0.000 -0.000
## PREP2*PPSS2 -0.000 -0.000  0.000 -0.000   0.421  0.000  0.000
## PREP2*PPSS3 -0.000 -0.000 -0.000  0.000   0.336  0.000  0.000
## PREP3*PPSS1 -0.000 -0.000 -0.000  0.000   0.236  0.000  0.000
## PREP3*PPSS2 -0.000 -0.000  0.000 -0.000   0.555 -0.000 -0.000
## PREP3*PPSS3 -0.000 -0.000 -0.000  0.000   0.466 -0.000 -0.000
## PREP4*PPSS1  0.000 -0.000  0.000  0.000   0.900 -0.000 -0.000
## PREP4*PPSS2 -0.000 -0.000 -0.000 -0.000   0.836 -0.000  0.000
## PREP4*PPSS3  0.000 -0.000  0.000  0.000   0.859 -0.000  0.000
```

iii. Regression coefficients of paths between factors

```
report1$paths
```

```
##             SEC TRUST
## R^2       0.420 0.367
## AdjR^2    0.412 0.365
## REP       0.247     .
## INV       0.181     .
## POL       0.339     .
## FAML      0.011     .
## REP*POL  -0.105     .
## SEC           . 0.606
```

---

iv. Bootstrapped path coefficients: t-values, 95% CI

```
# use 1000 bootstraps and utilize 2 parallel cores
boot_pls <- bootstrap_model(seminr_model = pls_model1, nboot = 1000)

## Bootstrapping model using seminr...

## SEMinR Model successfully bootstrapped

#> Bootstrapping model using seminr...
#> SEMinR Model successfully bootstrapped

boots_report<-summary(boot_pls)

boots_report$bootstrapped_paths

##                  Original Est. Bootstrap Mean Bootstrap SD T Stat. 2.5% CI
## REP  ->  SEC             0.247          0.242        0.059   4.186   0.127
## INV  ->  SEC             0.181          0.185        0.056   3.225   0.075
## POL  ->  SEC             0.339          0.341        0.055   6.172   0.230
## FAML  ->  SEC            0.011          0.014        0.059   0.178  -0.103
## REP*POL  ->  SEC        -0.105         -0.021        0.125  -0.836  -0.202
## SEC  ->  TRUST           0.606          0.606        0.035  17.386   0.538
##                  97.5% CI
## REP  ->  SEC        0.355
## INV  ->  SEC        0.298
## POL  ->  SEC        0.449
## FAML  ->  SEC       0.127
## REP*POL  ->  SEC    0.186
## SEC  ->  TRUST      0.670
```

Q2: Common-Factor Models using CB-SEM

a. Create a common factor model using SEMinR, with the following characteristics:

i. Make it reflective

```
meansurement2_cf <- as.reflective(measurements1)
```

-

ii. Use the same structural model as before (you can just reuse it again!)

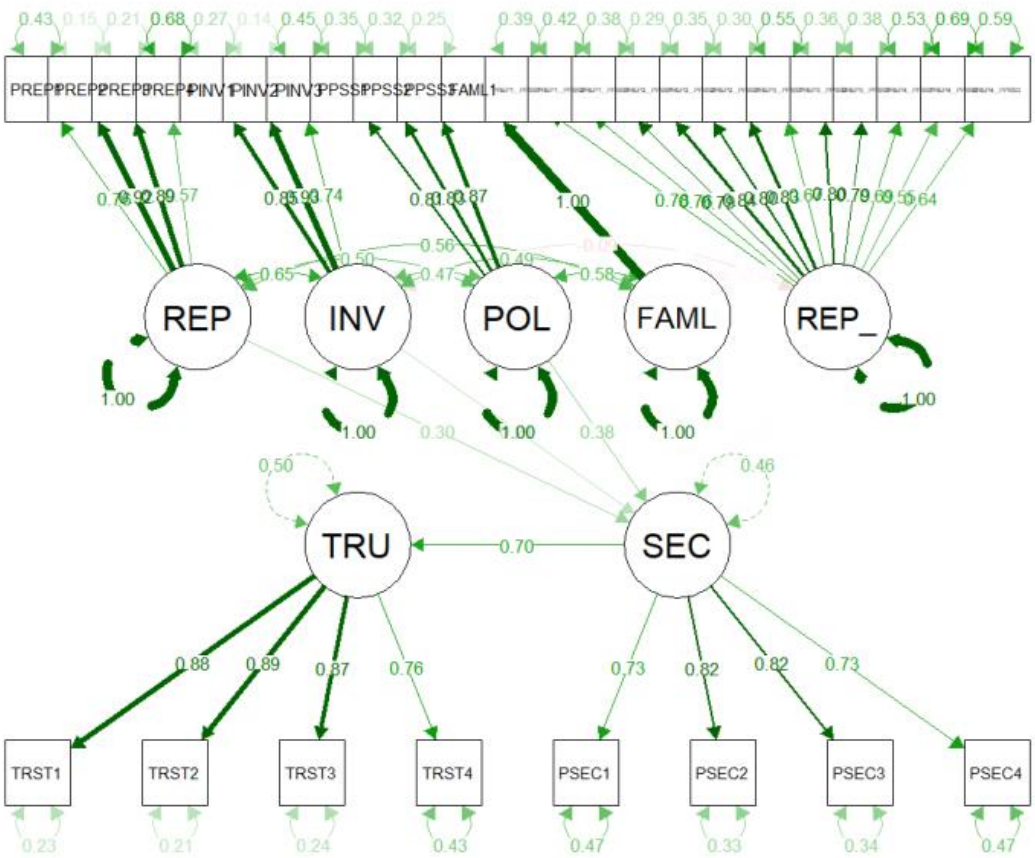
Ans:

```
structural_1 <-relationships(
  paths(from = c("REP", "INV", "POL","FAML", "REP*POL"), to = "SEC"),
  paths(from= "SEC",to= "TRUST"))

cbsem_model <-estimate_cbsem(data=df,
                             measurement_model = meansurement2_cf,
                             structural_model = structural_1)

## Generating the seminr model for CBSEM
```

b. Show us the following results in table or figure formats

i. Plot a figure of the estimated model (it will look different from your PLS model!)

```
plot(cbsem_model)
```



ii. Loadings of composites

```
cf_model_summary <- summary(cbsem_model)
cf_model_summary$loadings
```

```
## $coefficients
##           TRUST       SEC       REP       INV       POL FAML
## TRST1 0.8800240        NA        NA        NA        NA   NA
## TRST2 0.8886342        NA        NA        NA        NA   NA
## TRST3 0.8690644        NA        NA        NA        NA   NA
## TRST4 0.7575988        NA        NA        NA        NA   NA
## PSEC1        NA 0.7308766        NA        NA        NA   NA
## PSEC2        NA 0.8173481        NA        NA        NA   NA
## PSEC3        NA 0.8151708        NA        NA        NA   NA
## PSEC4        NA 0.7260444        NA        NA        NA   NA
## PREP1        NA        NA 0.7551328        NA        NA   NA
## PREP2        NA        NA 0.9199208        NA        NA   NA
## PREP3        NA        NA 0.8871362        NA        NA   NA
## PREP4        NA        NA 0.5650059        NA        NA   NA
## PINV1        NA        NA        NA 0.8520004        NA   NA
## PINV2        NA        NA        NA 0.9257476        NA   NA
## PINV3        NA        NA        NA 0.7388750        NA   NA
## PPSS1        NA        NA        NA        NA 0.8051533   NA
## PPSS2        NA        NA        NA        NA 0.8272576   NA
## PPSS3        NA        NA        NA        NA 0.8674335   NA
## FAML1        NA        NA        NA        NA        NA    1
```

iii. Regression coefficients of paths between factors, and their p-values

```
cf_model_summary$paths
```

```
## $coefficients
##                     SEC     TRUST
## R^2        0.540381651 0.4951084
## REP        0.299536782        NA
## INV        0.214253245        NA
## POL        0.376401499        NA
## FAML      -0.008837653        NA
## REP_x_POL  0.008355287        NA
## SEC                 NA 0.7036394
##
## $pvalues
##                     SEC TRUST
## REP       3.817182e-05    NA
## INV       3.534482e-03    NA
## POL       4.380975e-09    NA
## FAML      8.996836e-01    NA
## REP_x_POL 8.516847e-01    NA
## SEC                 NA     0
##
## $significance
##                   Std Estimate         SE      t-Value     2.5% CI   97.5% CI
## SEC -> REP         0.299536782 0.07273355 3.817182e-05  0.15698165 0.44209191
## SEC -> INV         0.214253245 0.07345058 3.534482e-03  0.07029275 0.35821374
## SEC -> POL         0.376401499 0.06413246 4.380975e-09  0.25070419 0.50209881
## SEC -> FAML       -0.008837653 0.07010617 8.996836e-01 -0.14624321 0.12856791
## SEC -> REP_x_POL   0.008355287 0.04468802 8.516847e-01 -0.07923162 0.09594219
## TRUST -> SEC       0.703639369 0.03721629 0.000000e+00  0.63069677 0.77658197
```