Business Analytics using Statistical Modeling
Assignment 15

Question 1

```
sec <- read.csv('../15-security_data.csv', header = TRUE)
```

a. Create a PLS path model with the following characteristics:

i. Measurement of constructs by items

1. Trust in website (TRUST): reflective construct with items TRST1-4

2. Perceived security of website (SEC): reflective construct with items PSEC1-4

3. Reputation of website (REP): formative construct with items PREP1-4

4. Investment in website (INV): reflective construct with PINV1-3

5. Perception of policy (POL): reflective construct with items PPSS1-3

6. Familiarity with website (FAML): single-item construct measured by FAML1

```
library(seminr)
```

```
##
## Attaching package: 'seminr'
```

```
## The following object is masked from 'package:base':
##
##     structure
```

```
# Measurement model
sec_mm <- measure(
  form('REP', multi_items('PREP', 1:4)),
  reflect('INV', multi_items('PINV', 1:3)),
  reflect('POL', multi_items('PPSS', 1:3)),
  reflect('FAML', single_item('FAML1')),
  reflect('SEC', multi_items('PSEC', 1:4)),
  reflect('TRUST', multi_items('TRST', 1:4))
)
```

ii. Interaction between REP and POL (use orthogonalized product terms)

```
# Orthogonalized product terms
sec_int <- interact(
  interaction_ortho('REP', 'POL')
)
```

iii. Structural paths between constructs (shown as causal models – note direction of arrows):

1. SEC ← REP + INV + POL + FAML + REP.POL

2. TRUST ← SEC

```
# Structural model
sec_sm_int <- structure(
  paths(from = c('REP', 'INV', 'POL', 'FAML', 'REP.POL'), to = 'SEC'),
  paths(from = 'SEC', to = 'TRUST')
)

sec_pls_int <- estimate_model(
  data = sec,
  measurement_model = sec_mm,
  interactions = sec_int,
  structural_model = sec_sm_int
)
```

```
## Generating the plsm model
```

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

i. Loadings of reflective factors / Weights of formative factors

Loadings:

```
sec_pls_int$outer_loadings
```

```
##                   REP       INV       POL FAML   REP.POL       SEC
## PREP1       0.5623877 0.0000000 0.0000000    0 0.0000000 0.0000000
## PREP2       0.8723808 0.0000000 0.0000000    0 0.0000000 0.0000000
## PREP3       0.9127721 0.0000000 0.0000000    0 0.0000000 0.0000000
## PREP4       0.7500201 0.0000000 0.0000000    0 0.0000000 0.0000000
## PINV1       0.0000000 0.9034426 0.0000000    0 0.0000000 0.0000000
## PINV2       0.0000000 0.9248641 0.0000000    0 0.0000000 0.0000000
## PINV3       0.0000000 0.8546257 0.0000000    0 0.0000000 0.0000000
## PPSS1       0.0000000 0.0000000 0.8678161    0 0.0000000 0.0000000
## PPSS2       0.0000000 0.0000000 0.8931576    0 0.0000000 0.0000000
## PPSS3       0.0000000 0.0000000 0.9110954    0 0.0000000 0.0000000
## FAML1       0.0000000 0.0000000 0.0000000    1 0.0000000 0.0000000
## PSEC1       0.0000000 0.0000000 0.0000000    0 0.0000000 0.8106163
## PSEC2       0.0000000 0.0000000 0.0000000    0 0.0000000 0.8652285
## PSEC3       0.0000000 0.0000000 0.0000000    0 0.0000000 0.8680697
## PSEC4       0.0000000 0.0000000 0.0000000    0 0.0000000 0.8094425
## TRST1       0.0000000 0.0000000 0.0000000    0 0.0000000 0.0000000
## TRST2       0.0000000 0.0000000 0.0000000    0 0.0000000 0.0000000
## TRST3       0.0000000 0.0000000 0.0000000    0 0.0000000 0.0000000
## TRST4       0.0000000 0.0000000 0.0000000    0 0.0000000 0.0000000
## PREP1.PPSS1 0.0000000 0.0000000 0.0000000    0 0.5836738 0.0000000
## PREP1.PPSS2 0.0000000 0.0000000 0.0000000    0 0.5125196 0.0000000
## PREP1.PPSS3 0.0000000 0.0000000 0.0000000    0 0.5088870 0.0000000
## PREP2.PPSS1 0.0000000 0.0000000 0.0000000    0 0.5134612 0.0000000
## PREP2.PPSS2 0.0000000 0.0000000 0.0000000    0 0.4244352 0.0000000
## PREP2.PPSS3 0.0000000 0.0000000 0.0000000    0 0.3398300 0.0000000
## PREP3.PPSS1 0.0000000 0.0000000 0.0000000    0 0.2395725 0.0000000
## PREP3.PPSS2 0.0000000 0.0000000 0.0000000    0 0.5576592 0.0000000
## PREP3.PPSS3 0.0000000 0.0000000 0.0000000    0 0.4690182 0.0000000
## PREP4.PPSS1 0.0000000 0.0000000 0.0000000    0 0.9011031 0.0000000
## PREP4.PPSS2 0.0000000 0.0000000 0.0000000    0 0.8363827 0.0000000
## PREP4.PPSS3 0.0000000 0.0000000 0.0000000    0 0.8599362 0.0000000
##                  TRUST
## PREP1       0.0000000
## PREP2       0.0000000
## PREP3       0.0000000
## PREP4       0.0000000
## PINV1       0.0000000
## PINV2       0.0000000
## PINV3       0.0000000
## PPSS1       0.0000000
## PPSS2       0.0000000
## PPSS3       0.0000000
## FAML1       0.0000000
## PSEC1       0.0000000
## PSEC2       0.0000000
## PSEC3       0.0000000
## PSEC4       0.0000000
## TRST1       0.8997565
```

```
## TRST2       0.9092024
## TRST3       0.9045716
## TRST4       0.8381919
## PREP1.PPSS1 0.0000000
## PREP1.PPSS2 0.0000000
## PREP1.PPSS3 0.0000000
## PREP2.PPSS1 0.0000000
## PREP2.PPSS2 0.0000000
## PREP2.PPSS3 0.0000000
## PREP3.PPSS1 0.0000000
## PREP3.PPSS2 0.0000000
## PREP3.PPSS3 0.0000000
## PREP4.PPSS1 0.0000000
## PREP4.PPSS2 0.0000000
## PREP4.PPSS3 0.0000000
```

Weights:

```
sec_pls_int$outer_weights
```

```
##                     REP       INV       POL FAML     REP.POL       SEC
## PREP1       -0.2434963 0.0000000 0.0000000    0  0.00000000 0.0000000
## PREP2        0.4418170 0.0000000 0.0000000    0  0.00000000 0.0000000
## PREP3        0.5144356 0.0000000 0.0000000    0  0.00000000 0.0000000
## PREP4        0.3759155 0.0000000 0.0000000    0  0.00000000 0.0000000
## PINV1        0.0000000 0.3633141 0.0000000    0  0.00000000 0.0000000
## PINV2        0.0000000 0.3949797 0.0000000    0  0.00000000 0.0000000
## PINV3        0.0000000 0.3585944 0.0000000    0  0.00000000 0.0000000
## PPSS1        0.0000000 0.0000000 0.3604446    0  0.00000000 0.0000000
## PPSS2        0.0000000 0.0000000 0.3947092    0  0.00000000 0.0000000
## PPSS3        0.0000000 0.0000000 0.3673192    0  0.00000000 0.0000000
## FAML1        0.0000000 0.0000000 0.0000000    1  0.00000000 0.0000000
## PSEC1        0.0000000 0.0000000 0.0000000    0  0.00000000 0.2708136
## PSEC2        0.0000000 0.0000000 0.0000000    0  0.00000000 0.3163641
## PSEC3        0.0000000 0.0000000 0.0000000    0  0.00000000 0.3064275
## PSEC4        0.0000000 0.0000000 0.0000000    0  0.00000000 0.2974225
## TRST1        0.0000000 0.0000000 0.0000000    0  0.00000000 0.0000000
## TRST2        0.0000000 0.0000000 0.0000000    0  0.00000000 0.0000000
## TRST3        0.0000000 0.0000000 0.0000000    0  0.00000000 0.0000000
## TRST4        0.0000000 0.0000000 0.0000000    0  0.00000000 0.0000000
## PREP1.PPSS1  0.0000000 0.0000000 0.0000000    0  0.23907580 0.0000000
## PREP1.PPSS2  0.0000000 0.0000000 0.0000000    0  0.03097791 0.0000000
## PREP1.PPSS3  0.0000000 0.0000000 0.0000000    0  0.02135493 0.0000000
## PREP2.PPSS1  0.0000000 0.0000000 0.0000000    0  0.04728616 0.0000000
## PREP2.PPSS2  0.0000000 0.0000000 0.0000000    0 -0.10299005 0.0000000
## PREP2.PPSS3  0.0000000 0.0000000 0.0000000    0 -0.22637248 0.0000000
## PREP3.PPSS1  0.0000000 0.0000000 0.0000000    0 -0.33874387 0.0000000
## PREP3.PPSS2  0.0000000 0.0000000 0.0000000    0  0.09519373 0.0000000
## PREP3.PPSS3  0.0000000 0.0000000 0.0000000    0  0.10857661 0.0000000
## PREP4.PPSS1  0.0000000 0.0000000 0.0000000    0  0.44220480 0.0000000
## PREP4.PPSS2  0.0000000 0.0000000 0.0000000    0  0.38056606 0.0000000
## PREP4.PPSS3  0.0000000 0.0000000 0.0000000    0  0.27087812 0.0000000
##                 TRUST
## PREP1       0.0000000
## PREP2       0.0000000
## PREP3       0.0000000
## PREP4       0.0000000
## PINV1       0.0000000
## PINV2       0.0000000
## PINV3       0.0000000
## PPSS1       0.0000000
## PPSS2       0.0000000
## PPSS3       0.0000000
## FAML1       0.0000000
## PSEC1       0.0000000
## PSEC2       0.0000000
## PSEC3       0.0000000
## PSEC4       0.0000000
## TRST1       0.2820685
## TRST2       0.2803331
## TRST3       0.2856284
```

```
## TRST4       0.2779270
## PREP1.PPSS1 0.0000000
## PREP1.PPSS2 0.0000000
## PREP1.PPSS3 0.0000000
## PREP2.PPSS1 0.0000000
## PREP2.PPSS2 0.0000000
## PREP2.PPSS3 0.0000000
## PREP3.PPSS1 0.0000000
## PREP3.PPSS2 0.0000000
## PREP3.PPSS3 0.0000000
## PREP4.PPSS1 0.0000000
## PREP4.PPSS2 0.0000000
## PREP4.PPSS3 0.0000000
```

ii. Regression coefficients of paths between factors

```
print_paths(sec_pls_int, digits = 2)
```

```
##           SEC TRUST
## R^2      0.44  0.37
## REP      0.30     .
## INV      0.17     .
## POL      0.32     .
## FAML     0.01     .
## REP.POL -0.11     .
## SEC         .  0.61
```

iii. Bootstrapped path coefficients: t-values, p-values (are any paths not significant at p=5% ?)

```
boot_pls <- bootstrap_model(
  data = sec,
  measurement_model = sec_mm,
  interactions = sec_int,
  structural_model = sec_sm_int,
  nboot = 1000
)
```

```
## Bootstrapping model using simplePLS...
```

```r
print_paths(boot_pls)
```

```
##          SEC PLS Est. SEC Boot Mean SEC Boot SE t value Pr(>|t|)
## REP             0.30          0.31        0.06    5.52     0.00
## INV             0.17          0.17        0.05    3.25     0.00
## POL             0.32          0.32        0.05    5.94     0.00
## FAML            0.01          0.01        0.05    0.13     0.90
## REP.POL        -0.11         -0.02        0.13   -0.18     0.85
## SEC             0.00          0.00        0.00    0.00     0.00
##          TRUST PLS Est. TRUST Boot Mean TRUST Boot SE t value Pr(>|t|)
## REP               0.00            0.00          0.00    0.00        0
## INV               0.00            0.00          0.00    0.00        0
## POL               0.00            0.00          0.00    0.00        0
## FAML              0.00            0.00          0.00    0.00        0
## REP.POL           0.00            0.00          0.00    0.00        0
## SEC               0.61            0.61          0.03   17.66        0
```

FAML and REP.POL are not significant at p = 5%.