1. Which of the following are true?
   1. Recursive models have unidirectional paths and independent residuals
   2. Non-recursive models have bidirectional paths and correlated error
   3. Recursive models can be fitted with standard multiple regression but non‐recursive models require structural equation software
   4. All of the above  
      *Correct – all of the above responses are true*
2. The following is a proposed theoretical model:

Physical Health

Esteem

Age

Stress

Why is it not possible to estimate this model using typical multiple regression?

1. Typical multiple regression would assume an error term for age, stress and esteem  
   *Incorrect, typical regression does not model error for the independent variables*
2. Typical multiple regression would assume that age, stress and esteem were correlated  
   *Correct, typical regression assumes correlations between the independent variables*
3. Typical multiple regression would assume that physical health is correlated with age, stress and esteem  
   *Incorrect, typical regression does not assume correlations between the IV and DVs*
4. Typical multiple regression would assume multivariate normality  
   *Incorrect, typical regression only assumes normality of residuals*
5. Which of the following is true?
   1. The larger the chi square value the greater the discrepancy between the model variance covariance matrix and the data's
   2. SRMR ranges between 0 and 1, and smaller values are better
   3. RMSEA is a parsimony-adjusted index that ‘rewards’ models analysed with larger samples, and with greater degrees of freedom
   4. All of the above  
      *Correct, all of the above are true*
6. Which of the following is true?
   1. Standard multiple regression procedures implicitly models correlations among predictors   
      *Correct,*
   2. Structural equation models require that there be correlations among predictor variables
   3. Structural equation models must be recursive in order to fit well
   4. All of the above
7. Which of the following are true?
   1. The Bollen-Stine test is a bootstrap method to test overall fit
   2. The ML (‘naïve’) bootstrap is used to estimate confidence intervals for model parameters
   3. Bootstrap methods are helpful when distributional assumptions are not met
   4. All of the above

*Correct, all of the above are true*

1. An important statistic for the normality assumption in SEM is
   1. Multivariate mode  
      *Incorrect*
   2. Multivariate kurtosis  
      *Correct, if we have a high level of multivariate kurtosis we should be worried that multivariate normality does not hold.*
   3. Multivariate mean  
      *Incorrect*
   4. All of the above  
      *Incorrect*
2. Which of the following is not a weakness of fit statistics
   1. They test only the average / overall fit of the model  
      *This is a common criticism of fit statistics, we could have good overall fit and poor fit for certain variables, and our overall fit statistics could look ok – look at the model and data variance-covariance matrices to inspect for this issue*
   2. Well fitting models do not necessarily have high explanatory power   
      *This is a common criticism of fit statistics, a good fitting model does not mean we have a good model*
   3. Fit statistics all reward large sample studies by showing good fit   
      *This is not a common criticism of fit statistics, although many are sensitive to sample size and may be inappropriate to use in large samples (e.g., chi square tests, which tend to show poor fit when we have a large amount of data points)*
   4. Fit statistics ignore person-level fit   
      *This is a common criticism of fit statistics, we could have good overall fit and poor fit for a subsample, this error could be systematic and our overall fit could look ok*
3. Overfitting
   1. Occurs when the model is overly complex

*Correct, overfitting models describe a sample well, but do not generalise outside of our sample or describe the population well*

* 1. Occurs when the model is too simple  
     *Incorrect,* *overfitting models describe a sample well, but do not generalise outside of our sample or describe the population well*
  2. Occurs when the data is too complex   
     *Incorrect,* *this response does not describe a possible situation*
  3. Occurs when the data is too simple   
     *Incorrect,* *this response does not describe a possible situation*

1. Which of the following can occur in SEM when assumptions are not met
   1. Model parameters can be inverted and standard errors estimated as negative values  
      *Incorrect*
   2. Models can be incorrectly rejected as not fitting and standard errors can be assumed to be smaller or larger than they are really are

Correct

* 1. Variance covariance matrices can be over-specified, leading to overfitting models   
     *Incorrect*
  2. Models can under-fit the data, and variance covariance matrices imprecisely characterise the associations among variables

*Incorrect*

1. Bollen-Stein bootstrap *p* values tell us:
   1. How often our dataset fit the model better than datasets sampled from the null hypothesis (i.e., datasets where the specified model is precisely true) according to chi square values   
      *Correct (see description of Bollen-Stein bootstrapping below)*
   2. How often our dataset fit the model worse than datasets sampled from the null hypothesis (i.e., datasets where the specified model is precisely true) according to chi square values *Incorrect*
   3. How often our dataset fit the model better than datasets sampled from the null hypothesis (i.e., datasets where the specified model is precisely true) according to RMSEA values   
      *Incorrect*
   4. How often our dataset fit the model better than datasets sampled from the null hypothesis (i.e., datasets where the specified model is precisely true) according to RMSEA values

*Incorrect*

*The Bollen-Stein bootstrap is described in the Amos documentation:*

*"The Bollen-Stine bootstrap process involves the transformation of the data to a data set for which the null hypothesis (that the default model fits the data) is true. [...] Each bootstrap sample is sampled from this transformed data and a chi-square is computed for the fit of that bootstrapped data to the model. These chi-squares [...] are compared internally to the chi-square that was computed for the observed data fit to the model. [...] The proportion of times that the model 'fit worse or failed to fit', i.e. the number of times that the model chi-square for the bootstrapped sample exceeded the chi-square for the observed data, is the Bollen-Stine bootstrap p value."*