

## MMA 867 In-class Group Discussion

### Principal Components Analysis

*M & S Associates* is a firm specializing in analysis for companies trying to improve management of their human resources. The firm conducts specially designed surveys of the employees of a company and then provides an analysis of results and recommendations for areas of possible improvement.

Typical *M & S* surveys contain dozens of questions targeting a much smaller number of underlying ‘themes’. For example, several questions might be scattered throughout the survey, all related to the theme of workplace health and safety but worded somewhat differently in each question. Also, some in a set of theme questions may be ‘reverse coded’ –asking a similar question but in an opposite sense. For example, below are two possible questions addressing the workplace safety theme:

*Management is responsive to health and safety issues raised by employees.*

*Managers don’t appear to care about the health and safety of workers.*

Responses are on a continuous ‘Likert scale’ – a ‘slider’ ranging from strongly disagree to strongly agree. Respondents who feel that health and safety are important for management might answer ‘strongly agree’ to the first question but should disagree with the second if they are paying attention. This and having multiple questions for the same themes are standard ways of checking for consistency in responses.

You have suggested to managers at *M & S* that they should use principal components analyses of survey data to check that responses are consistent with the underlying themes. If the survey is well designed, questions that relate to the same underlying theme should load together on a common component, and the number of components should match the number of themes.

*M & S* managers have provided a data set containing responses of 679 employees to 25 questions without revealing the nature of the survey, the content of the questions or the number of underlying themes. Your lack of knowledge about the details of the survey eliminates the possibility of interpretive bias. The questions are numbered as variables Q1 to Q25. The managers have challenged you to demonstrate that principal components analysis can reveal insights to the following topics:

- a) the number of themes,**
- b) which questions relate to which themes? Are ‘reversed-coded’ questions identifiable?**
- c) can you identify unusual employees whose responses are very different from the majority?**
- d) what other managerial insights can you draw from your analysis?**

The question responses in the spreadsheet accompanying this assignment have been screened and standardized to a common scale used by *M & S*.

Perform an analysis to answer the *M & S* challenge and report your findings in a short memo – maximum one-page. You may attach key excerpts from computer reports as separate exhibits.