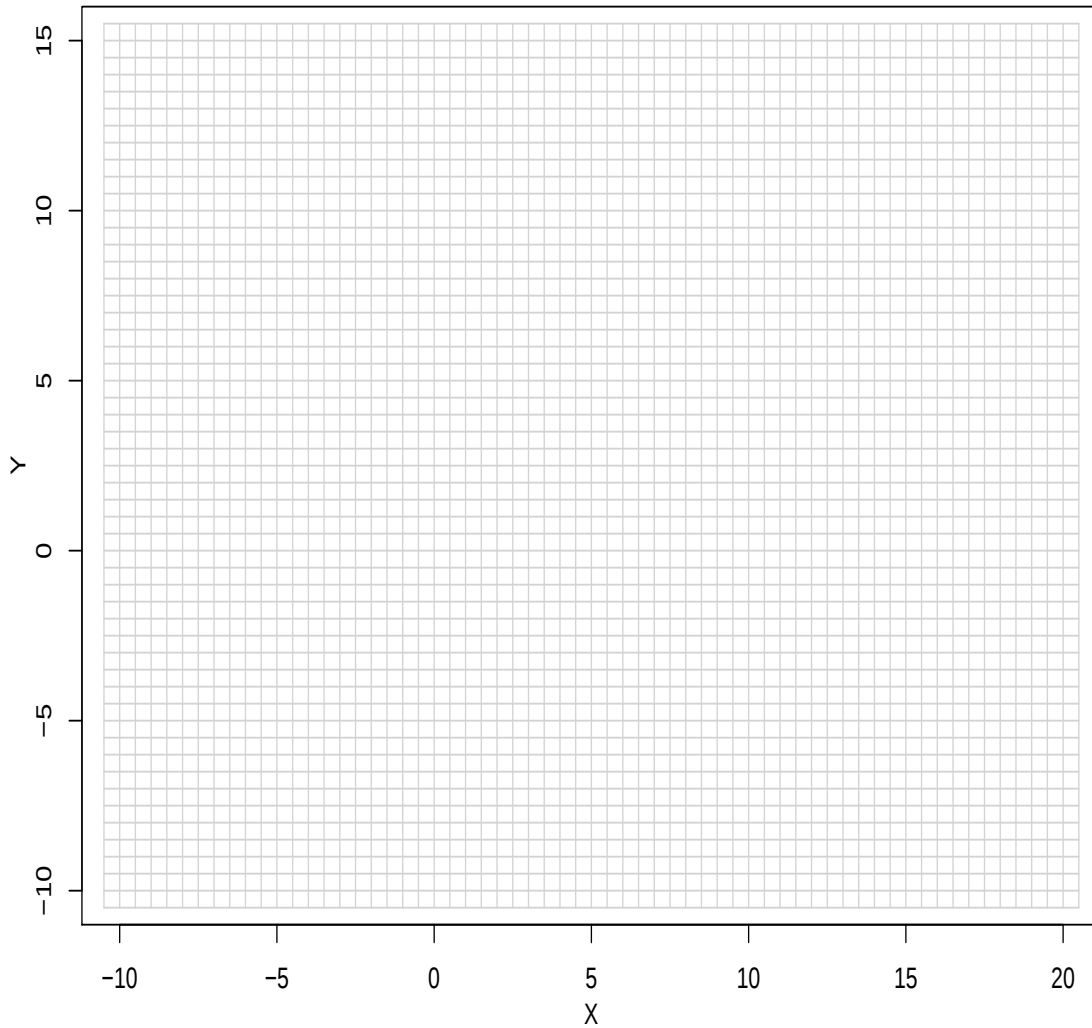


MG 301 Practice Problems

1. Let $\begin{pmatrix} X \\ Y \end{pmatrix} \sim N_2 \left(\begin{pmatrix} 5 \\ 2 \end{pmatrix}, \frac{1}{5} \begin{bmatrix} 102 & 36 \\ 36 & 48 \end{bmatrix} \right)$ Answer the following:
- Find the conditional distribution of $Y|X = x$.
 - Find the Principal Components and interpret them.
 - In the following graphing region, plot the smallest region where $(X, Y)'$ has a 95% joint probability of taking value, given that the 0.95-th quantile of χ^2_2 equals 6. The whole plot need not be perfect but the major and minor axes and the points where the region cut them must be plotted as accurately as possible.



2. In order to understand and measure Quality Management Practices employed by the Software industry, a 48 item questionnaire is designed. The items of the questionnaire attempt to measure 14 variables. Observations on each of these 14 variables are obtained by summing the Lickert scale responses of 3 to 4 items (of

the 48) of the questionnaire. The 14 variables (with a couple of sample items used to measure the variable given in the parentheses) are as follows: Completeness (Extent of Information on Software Requirements, System Requirements etc. that are collected before a project), Design Structure (Extent of Supportability, Menu-Driven features etc. that are incorporated in a software), Defect Density (Extent of Sensitivity to Flaw Detection, Feelers for Defects etc. that are incorporated in the code), Fault Density (Extent of Software Failures experienced by the customers, Undetected Software Faults etc.) Test Coverage (Extent of Software Stress, Structure etc. that are tested), Documentation (Extent of availability of Guidelines, On-line help etc.), Top Management Support (Extent of Assuming Responsibility for Quality, Relating Quality to Profit etc. by Top Management), Autonomy & Visibility (Extent of Visibility, Degree of Freedom etc. of the Quality Department), Role of the Quality Department (Extent of Effectiveness in Improving Quality, Coordination with other departments etc. of the Quality Department), Training (Extent of Specific Work-Skills, Quality Related training etc. that are imparted to the employees), Project Design (Extent of Involvement in Design by the affected departments, Frequency of Re-Design etc.), Reliability (Extent to which Customers are Followed up, Repeated Services etc.), Responsiveness (Extent of spontaneous Response to customers' problems, Customers' seek help etc.) and Empathy (Extent of Wavelength Difference with the Customers, Failed to Understand Customers etc.). A Factor Analysis on the correlations of these 14 variables were conducted resulting in the following factor loading matrix after varimax rotation:

Factors→ Variables↓	1	2	3
Completeness		0.65	
Design Structure		0.78	
Defect Density		0.66	
Fault Density		0.80	
Test Coverage		0.63	
Documentation		0.59	
Top Management Support	0.81		
Autonomy & Visibility	0.82		
Role of the Quality Department	0.88		
Training	0.86		
Project Design	0.84		
Reliability			0.50
Responsiveness			0.48
Empathy			0.35

Answer the following:

- Find the Communality of the standardized variable "Top Management Support".
- Find the Uniqueness of the standardized variable "Role of Quality Department".
- Find the correlation between Defect Density and Fault Density.
- Find the correlation between Empathy and Factor 3.
- What proportion of total variance of the 14 standardized variable is being explained by the First Factor?
- What proportion of total variance of the 14 standardized variable is being explained by the Three Factors?
- Appropriately name the three Factors and briefly explain their importance in determination of Quality Management Practice in the Software Industry.