St. Xavier's College (Autonomous), Kolkata

Department of Statistics

Problem Set 5

MDSC 4113/SEM I/CORE3 **DATE:**

1. Plot the following system of linear equations and comment on solvability:
   i. $5x_1 - 4x_2 = -10$
      $-x_1 + x_2 = 2$

   ii. x - 2y = 1
      3x - 6y = 3

   iii. x - 2y = 1
      3x - 6 Y = 11

   iv. $x_1 - x_2 = 2$
      $2x_1 + 2x_2 = 1$
      $3x_1 + x_2 = 6$

   v. $13x_1$-$4x_2$+$2x_3$=1
      -$4x_1$+$11x_2$-$2x_3$=2
      $2x_1$-$2x_2$+$8x_3$=6

   vi. x_1 + $2x_2$+ $3x_3$ = 6
      $2x_1$+ $5x_2$+ $2x_3$ = 4
      $6x_1$ - $3x_2$+ $1x_3$ = 2

2. A beverage company has two production sites A and B and they want to transport their beverage to two distributors C and D. The demand from distributor C is 542 bottles per week, and the demand from distributor D is 422 bottles per week. The supply from production site A is 475 bottles per week, and the supply from production site B is 489 bottles per week. We want to know if these sites produce enough beverage to satisfy the demands from the distributors. Formulate this problem as a system of linear equations.
3. An investor will invest a total of $15,000 in two accounts, one paying 4% annual simple interest and the other 3%. If he wants to earn $550 annual interest, how much should he invest at each rate?
4. Solve the following system of equation using Gaussian elimination, LU factorization, QR and Cholesky factorization:
   i) x_1 + $3x_2$- $2x_3$ = - 4
   $3x_1 + 7x_2 + x_3 = 4$
   -$2x_1 + x_2 + 7x_3$= 7

   ii) Also apply Jacobi and Gauss Seidel methods to solve i).

5. Set the seed at 4865299. Create a 4x3 matrix M by generating values from uniform (0, 1). Solve the system of equations Mx = b, where b = (1, 2, 3, 4) using Gaussian elimination, LU decomposition and QR factorization.
6. Set the seed at 4865299. Create a 6x6 symmetric matrix M by generating values from uniform (0, 1). Factorise it using Cholesky decomposition. Hence solve the system of equations Mx = b, where b = (1, 2, 3, 4, 5, 6).