**feigenMDS Problems for presentation**

**R. No. Problem**

35 Find a basis for the eigenspace corresponding to each eigenvalue of the matrix

A= .

34 Orthogonally diagonalize the matrix .

33. Summarize section **1.1 Systems of Linear Equations** solving some typical problems.

32 Transforms the quadratic form x12 + 10x1x2 + x22 into a quadratic form with no cross-product term. Give the transformation matrix and the new quadratic form.

30. Summarize section **1.2 Row Reduction and Echelon Forms** solving some typical problems.

29. Find an SVD of the matrix .

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31. Find (a) the maximum value of Q(**x) =** x12 + x22 – 10x1x2 subject to the constraint **x**T**x** =1, (b) a unit vector **u** where this maximum is attained.

27. Find (a) the maximum value of Q(**x) = 3**x12 + 9x22 + 8x1x2 subject to the constraint **x**T**x** =1, (b) a unit vector **u** where this maximum is attained,

26. Determine the definiteness of the quadratic form Q(**x) = 2**x12 – 4x1x2 – x22 . Transforms the quadratic form into one with no cross-product term.

**The next presentation will be on Sunday, 12 May, 2024.**

**1.** Find the eigenvalues and eigenvectors of **A** = . State the effect of multiplying the eigenvector by the matrix **A**. Plot the eigenspaces *Eλ* and write down a basis vector for each of the eigenspaces.

**2.** Summarize section **1.3 Vector Equations** solving some typical problems.

**3.** Determine the eigenvalues and eigenvectors of **A** = .

**4.** Prove that the eigenvalues of the transposed matrix, **A***T*, are exactly the eigenvalues of the matrix **A**.

**5.** For the matrix **A** = find:

(i) The eigenvalues and corresponding eigenvectors.

(ii) Matrices **P** and **D** where **P** is the invertible (non-singular) matrix and **D** = **P**−1**AP** is the diagonal matrix.

(iii) Determine **A**4 in each case by using the results of parts (i) and (ii).

**6.** For the matrix **A** = determine whether it is diagonalizable.

**7.** Show that the following matrices are *not* diagonalizable:

**(a) A** =  **(b) A** = .

**8.** If matrices **A** and **B** are similar, prove that det (**A**)= det (**B**).

**9.** Show that if **A** is a diagonal matrix then orthogonal diagonalising matrix **Q** = **I**.

**10.** Summarize section **1.6 Applications of Linear Systems** solving some typical problems.

**11.** Prove that **A** = is orthogonally diagonalisable and find the orthogonal matrix **Q** which diagonalizes the matrix **A**.

**12.** Determine the matrices **U**, **D** and **V** such that **A** = **UDV***T* for the matrix **A** = .

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**14.** Determine the matrices **U**, **D** and **V** such that **A** = **UDV***T* for the matrix

**A** = .

**15.** Express the quadratic form *x*2 + 2*xy* + 4*xz* + 2*y*2 +10*yz* + 5*z*2 into **x***T***Ax.** Check your answer.

**16.** Summarize section **1.4 The Matrix Equation Ax = b** solving some typical problems.

**17.** Express the quadratic form –2*x*2 + 6*xy* – 32*y*2 – 24*yz* + *z*2 into **x***T***Ax.** Check your answer.

**18.** Transform the quadratic form 3*x*2 + 8*xy* – 3*y*2 + 5*z*2 into diagonal form.

**19.** Transform the quadratic form 2*x*2 + 4*xy* + 4*xz* + 2*y*2 + 4*yz* + 2*z*2 into diagonal form.

**20.** Show that the symmetric matrix **A** = is positive definite if and only if

*a* > *b* > 0 .

**21.** Find the maximum and minimum values of the quadratic form 5*x*2 + 5*xy* subject to the constraint *x*2 + *y*2 = 1.

**22.** Summarize section **1.5 Solution Sets of Linear Systems** solving some typical problems.

**23.** A rectangle whose center is at the origin and whose sides are parallel to the coordinate axes is to be inscribed in the ellipse *x*2 + 25*y*2 = 25*.* Use eigenvalue method to find nonnegative values of *x* and *y* that produce the inscribed rectangle with maximum area.

**24.** Let

*A* = and *P* = .

Confirm that *P* diagonalizes *A*, and then compute *A*11.

**25.** Find a matrix *P* that diagonalizes the matrix

*A* = .