Aricayos, Red Ingram M. October 12, 2017

BSIT-3B

1. What is a Row matrix? Give an example.

* A **row matrix** is an ordered list of numbers written in a row.
  + Example – (12.5, -9.34)

--- http://chortle.ccsu.edu/vectorlessons/vch01/vch01\_6.html

1. How many leading nonzero entries can an m x n matrix have?

-m x n matrix can have as many nonzero as it can, because it is not in reduced row-echelon or row-echelon form so it is not restricted to only have one leading nonzero.

1. If A and B are echelon matrices with the same size. Show that the sum A+B need not be an echelon matrix by giving your own example.

A= B= A+B=

1. When is a matrix A is said to be in row canonical form?

-If it satisfies the following condition, [1] it is in row echelon form. [2] every leading coefficient is 1 and is the only nonzero entry in its column.

---https://en.wikipedia.org/wiki/Row\_echelon\_form

1. One speaks of “an” echelon form of a matrix A, “the” row canonical form of a, why?

- A matrix is in **reduced row echelon form** (also called **row canonical form**) if it satisfies the following conditions:

[1] It is in row echelon form.

[2] Every leading coefficient is 1 and is the only nonzero entry in its column.

-- <https://en.wikipedia.org/wiki/Row_echelon_form>

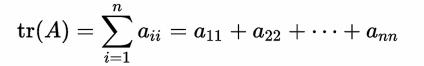
1. When is a matrix A called a block matrix?

- Intuitively, a matrix interpreted as a block matrix can be visualized as the original matrix with a collection of horizontal and vertical lines, which break it up, or [partition](https://en.wikipedia.org/wiki/Partition_of_a_set) it, into a collection of smaller matrices. Any matrix may be interpreted as a block matrix in one or more ways, with each interpretation defined by how its rows and columns are partitioned. This notion can be made more precise for an {\displaystyle n}n by m{\displaystyle m}mmm matrix M{\displaystyle M}MMM by partitioning n {\displaystyle n}into a collection rowgroups{\displaystyle rowgroups}, and then partitioning m{\displaystyle m}m into a collection colgroups{\displaystyle colgroups}. The original matrix is then considered as the "total" of these groups, in the sense that the (i, j){\displaystyle (i,j)} entry of the original matrix corresponds in a [1-to-1](https://en.wikipedia.org/wiki/Bijection) way with some (s, t){\displaystyle (s,t)} [offset](https://en.wikipedia.org/wiki/Offset_(computer_science)) entry of some (x, y){\displaystyle (x,y)}, where x  {\displaystyle x\in {\mathit {rowgroups}}} and {\displaystyle y\in {\mathit {colgroups}}}.

-- <https://en.wikipedia.org/wiki/Block_matrix>

1. Define the trace of an n-square matrix.

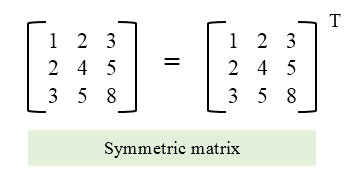
- the **trace** of an *n*-by-*n* [square matrix](https://en.wikipedia.org/wiki/Square_matrix) *A* is defined to be the sum of the elements on the [main diagonal](https://en.wikipedia.org/wiki/Main_diagonal)(the diagonal from the upper left to the lower right) of *A*, i.e.,



Where *aii* denotes the entry on the *i*th row and *i*th column of *A*. The trace of a matrix is the sum of the (complex) [eigenvalues](https://en.wikipedia.org/wiki/Eigenvalue), and it is [invariant](https://en.wikipedia.org/wiki/Invariants_of_tensors) with respect to a [change of basis](https://en.wikipedia.org/wiki/Change_of_basis). This characterization can be used to define the trace of a linear operator in general. Note that the trace is only defined for a square matrix (i.e., *n* × *n*).

--- https://en.wikipedia.org/wiki/Trace\_(linear\_algebra)

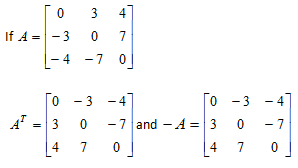
1. Define a symmetric matrix

* A **symmetric matrix** is a [square matrix](https://en.wikipedia.org/wiki/Square_matrix) that is equal to its [transpose](https://en.wikipedia.org/wiki/Transpose). Formally, matrix *A* is symmetric if **A=At.** Because equal matrices have equal dimensions, only square matrices can be symmetric.
* 

--- https://en.wikipedia.org/wiki/Symmetric\_matrix

1. Define a skew-symmetric matrix

* A **skew-symmetric** (or **antisymmetric** or **antimetric**[[1]](https://en.wikipedia.org/wiki/Skew-symmetric_matrix#cite_note-1)) **matrix** is a [square matrix](https://en.wikipedia.org/wiki/Square_matrix) whose [transpose](https://en.wikipedia.org/wiki/Transpose) equals its negative; that is, it satisfies the condition **At=-A.** In terms of the entries of the matrix, if *aij* denotes the entry in the *i* th row and *j* th column; i.e., *A* = (*aij*), then the skew-symmetric condition is *aji* = −*aij*
  + Example



---https://en.wikipedia.org/wiki/Skew-symmetric\_matrix

1. Define orthogonal matrix

- an **orthogonal matrix** or **real orthogonal matrix** is a [square matrix](https://en.wikipedia.org/wiki/Square_matrix) with [real](https://en.wikipedia.org/wiki/Real_number) entries whose columns and rows are [orthogonal](https://en.wikipedia.org/wiki/Orthogonal) [unit vectors](https://en.wikipedia.org/wiki/Unit_vector) (i.e., [orthonormal](https://en.wikipedia.org/wiki/Orthonormality) vectors), i.e.

Where {\displaystyle I}  is the [identity matrix](https://en.wikipedia.org/wiki/Identity_matrix). This leads to the equivalent characterization: a matrix *Q* is orthogonal if its [transpose](https://en.wikipedia.org/wiki/Transpose) is equal to its [inverse](https://en.wikipedia.org/wiki/Inverse_matrix):

https://en.wikipedia.org/wiki/Orthogonal\_matri0078

1. Show that the given matrix is orthogonal.
2. Define normal matrix

- In mathematics, a complex square matrix A is normal if A\*A=AA\* where A∗ is the conjugate transpose of A. That is, a matrix is normal if it commutes with its conjugate transpose. A real square matrix A satisfies A∗ = AT, and is therefore normal if ATA = AAT. A matrix is normal if and only if it is unitarily similar to a diagonal matrix, and therefore any matrix A satisfying the equation A∗A = AA∗ is diagonalizable. The concept of normal matrices can be extended to normal operators on infinite dimensional Hilbert spaces and to normal elements in C\*-algebras. As in the matrix case, normality means commutativity is preserved, to the extent possible, in the noncommutative setting. This makes normal operators, and normal elements of C\*-algebras, more amenable to analysis.

--- <https://en.wikipedia.org/wiki/Normal_matrix>

1. Define a square block matrix

-A **block matrix** or a **partitioned matrix** is a [matrix](https://en.wikipedia.org/wiki/Matrix_(mathematics)) that is *interpreted* as having been broken into sections called **blocks** or **submatrices**.[[1]](https://en.wikipedia.org/wiki/Block_matrix#cite_note-1) Intuitively, a matrix interpreted as a block matrix can be visualized as the original matrix with a collection of horizontal and vertical lines, which break it up, or [partition](https://en.wikipedia.org/wiki/Partition_of_a_set) it, into a collection of smaller matrices.[[2]](https://en.wikipedia.org/wiki/Block_matrix#cite_note-2) Any matrix may be interpreted as a block matrix in one or more ways, with each interpretation defined by how its rows and columns are partitioned.

-- <https://en.wikipedia.org/wiki/Block_matrix>

- [A B; C D], A block matrix is a [matrix](http://mathworld.wolfram.com/Matrix.html) that is defined using smaller matrices, called blocks. For example,

|  |
| --- |
|  |

--- http://mathworld.wolfram.com/BlockMatrix.html

1. Define an idempotent matrix

- An **idempotent matrix** is a [matrix](https://en.wikipedia.org/wiki/Matrix_(mathematics)) which, when multiplied by itself, yields itself. That is, the matrix *M* is idempotent if and only if *MM* = *M*. For this product *MM* to be [defined](https://en.wikipedia.org/wiki/Matrix_multiplication), *M* must necessarily be a [square matrix](https://en.wikipedia.org/wiki/Square_matrix). Viewed this way, idempotent matrices are [idempotent elements](https://en.wikipedia.org/wiki/Idempotent_element_(ring_theory)) of [matrix rings](https://en.wikipedia.org/wiki/Matrix_ring).

--- https://en.wikipedia.org/wiki/Idempotent\_matrix

1. Define an involuntary matrix

- An **involutory matrix** is a [matrix](https://en.wikipedia.org/wiki/Matrix_(mathematics)) that is its own inverse. That is, multiplication by matrix **A** is an [involution](https://en.wikipedia.org/wiki/Involution_(mathematics)) if and only if **A**2 = **I**. Involutory matrices are all [square roots](https://en.wikipedia.org/wiki/Square_root_of_a_matrix) of the [identity matrix](https://en.wikipedia.org/wiki/Identity_matrix). This is simply a consequence of the fact that any [nonsingular matrix](https://en.wikipedia.org/wiki/Nonsingular_matrix) multiplied by its inverse is the identity.

---https://en.wikipedia.org/wiki/Involutory\_matrix