

St. Xavier's College (Autonomous), Kolkata

Department of Statistics

MSc in Data Science

Paper code: MDSC 4113

Module 1

Linear Algebra

Handout for Problem sheet 2

2.1 Matrices (Syntax)

2.1.1 Identity Matrix of size n

```
A <- diag(n)
```

2.1.2 0-matrix and 1-matrix

- `matrix(0, nrow = m, ncol = n)`: All elements 0
- `matrix(1, nrow = m, ncol = n)`: All elements 1

2.1.3 Inputting a Matrix (Syntax)

- `matrix(data, nrow, ncol, byrow)`
- `data` is the input vector which becomes the data elements of the matrix.
- `nrow` is the number of rows to be created.
- `ncol` is the number of columns to be created.
- `byrow` is a logical clue. If TRUE then the input vector elements are arranged by row.

When a matrix is constructed directly with data elements, the matrix content is filled along the column orientation by default.

Example: Check the outputs in the following cases:

```
A <- matrix(c(1, 3, 2, 2, 8, 9), ncol = 3)
```

```
B <- matrix(c(1, 3, 2, 2, 8, 9), ncol = 3, byrow = T)
```

2.1.4 you can also create a matrix from a vector by setting its dimension using `dim()`

```
x <- c(1, 2, 3, 4, 5, 6)
```

```
dim(x) <- c(2, 3)
```

x

- An element at the mth row, nth column of A can be accessed by the expression `A[m, n]`
- The entire mth row A can be extracted as `A[m,]`
- nth column A can be extracted as `A[,n]`

- extract more than one rows or columns at a time: A[,c(m,n)]
- Create a matrix by deleting the first row of A: A[-1,]
- The dim function is used to find the number of rows and the number of columns

2.2 Transpose

t(A)

2.3 Combining Matrices

The columns of two matrices having the same number of rows can be combined into a larger matrix
cbind(B, C)

we can combine the rows of two matrices if they have the same number of columns

rbind(A, B)

2.4 Deconstruction

We can deconstruct a matrix by applying the c function, which combines all column vectors into one.

c(B)

2.5 Multiplying a matrix with a vector

Post multiplying a matrix with a vector: $A^{m \times n} \underline{b}^{n \times 1} = \underline{c}^{m \times 1}$

c <- A%*%b

The operation A*b gives element by element product

2.6 Multiplication of matrices

The product AB can only be formed if the number of rows in B and the number of columns in A are the same.

$$A^{m \times n} B^{n \times r} = C^{m \times r}$$

A%*%B

$$A * B \quad \left[\text{If } A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, B = \begin{bmatrix} e & f \\ g & h \end{bmatrix}, A * B = \begin{bmatrix} a * e & b * f \\ c * g & d * h \end{bmatrix} \right]$$

2.7 Inverse of Matrices

If A is a square matrix

solve(A)