R Programming Language Lab

LAB EXPERIMENT NO. 10 R Programming Language - Asst. Prof. Ashwini Mathur(SET-JAIN)

1. Use R-function matrix to create the matrices called A and B:
2. Take the inverse of A and the transpose of A.
3. Multiply A with B.
4. Estimate the eigenvalues and eigenvectors of A.
5. For a matrix A, x is an eigenvector, and λ the eigenvalue of a matrix A, if A • x = λ • x. Test it!
6. Create a new matrix, T, which equals P, except for the first row, where the elements are 0.
7. Now estimate N= (I-T)-1, where I is the identity matrix.
8. Find the root of the equation f(x) = cos(2x)^3 in the interval [0, 8]. And draw the function curve.

Self work .....

9. Solve the equations 1000 = y ∗ (3 + x) ∗ (1 + y)4 for y and with x varying over the range from 1 to

Question:1. Use R-function matrix to create the matrices called A and B.

```
A <- matrix( c(1,1,-2,-1,2,1,0,1,-1), nrow=3, byrow=TRUE)
B <- matrix( c(6, 2, 0,8,-2, 2,4, 2,-2), nrow=3, byrow=TRUE)

A #print matrix A
B #Print matrix B
```

A matrix: 3 × 3 of type dbl

1	1	-2
-1	2	1
0	1	-1

A matrix: 3 × 3 of type dbl

6	2	0
8	-2	2
4	2	-2

One of the most widely used kinds of matrix decomposition is called eigendecomposition, in which w

Question:2. Take the inverse of A and the transpose of A.

Need to install the packgae and load the library for inverse of the matrix

```
install.packages("matlib")
library(matlib)
```

```
Installing package into 'C:/Users/ashwinmathur/Documents/R/win-library/3.6'
(as 'lib' is unspecified)
Warning message:
"package 'matlib' is in use and will not be installed"
```

det(A) != 0, so inverse exists **Only non-singular matrices have an inverse**

```
det(A) #Determinant of A
det(t(A))
```

```
-2
-2
```

```
AI = inv(A)
AI
```

A matrix: 3 × 3 of type dbl

1.5	0.5	-2.5
0.5	0.5	-0.5
0.5	0.5	-1.5

```
transpose = t(AI) #Transpose of Matrix
transpose
```

A matrix: 3 × 3 of type dbl

1.5	0.5	0.5
0.5	0.5	0.5
-2.5	-0.5	-1.5

```
e = eigen(A)
e$values
```

```
2 · 1 · -1
```

Question:3. Multiply A with B

```
Mul = A * B
Mul
```

A matrix: 3 × 3 of type dbl

6	2	0
-8	-4	2
0	2	2

Question:4. Estimate the eigenvalues and eigenvectors of A.

```
ev = eigen(A) #Eigen value of the matrix A
ev
```

```
eigen() decomposition
$values
[1]  2  1 -1

$vectors
          [,1]       [,2]          [,3]
[1,] 0.3015113 -0.8017837  7.071068e-01
[2,] 0.9045340 -0.5345225 -1.922963e-16
[3,] 0.3015113 -0.2672612  7.071068e-01
```

```
x = ev$values #assign X to eigen values
```

```
lamda = ev$vectors #assign lamda to eigen vectors
```

Question:5. For a matrix A, x is an eigenvector, and λ the eigenvalue of a matrix A, if A • x = λ • x. Test

```
A*x == lamda*x
```

A matrix: 3 × 3 of type lgl

FALSE	FALSE	FALSE
FALSE	FALSE	FALSE
FALSE	FALSE	FALSE

```
I <- matrix( c(1, 0, 0,0,1, 0,0, 0,1), nrow=3, byrow=TRUE)
```

```
A - (lamda*I)
```

A matrix: 3 × 3 of type dbl

0.6984887	1.000000	-2.000000

```
lamda*x
```

A matrix: 3 × 3 of type dbl

0.6030227	-1.6035675	1.414214e+00
0.9045340	-0.5345225	-1.922963e-16
-0.3015113	0.2672612	-7.071068e-01

```
A*x
```

A matrix: 3 × 3 of type dbl

2	2	-4
-1	2	1
0	-1	1

Question:6. Create a new matrix, T, which equals P, except for the first row, where the elements are 0.

```
T = matrix( c(0,0,0,-1,2,1,0,1,-1), nrow=3, byrow=TRUE)
P = matrix( c(1,1,-2,-1,2,1,0,1,-1), nrow=3, byrow=TRUE)
```

Question:7. Now estimate N= (I-T)-1, where I is the identity matrix.

```
I = matrix( c(1,0,0,0,1,0,0,0,1), nrow=3, byrow=TRUE)
I
```

A matrix: 3 × 3 of type dbl

1	0	0
0	1	0
0	0	1

Question:8. Now estimate N= (I-T)-1, where I is the identity matrix.

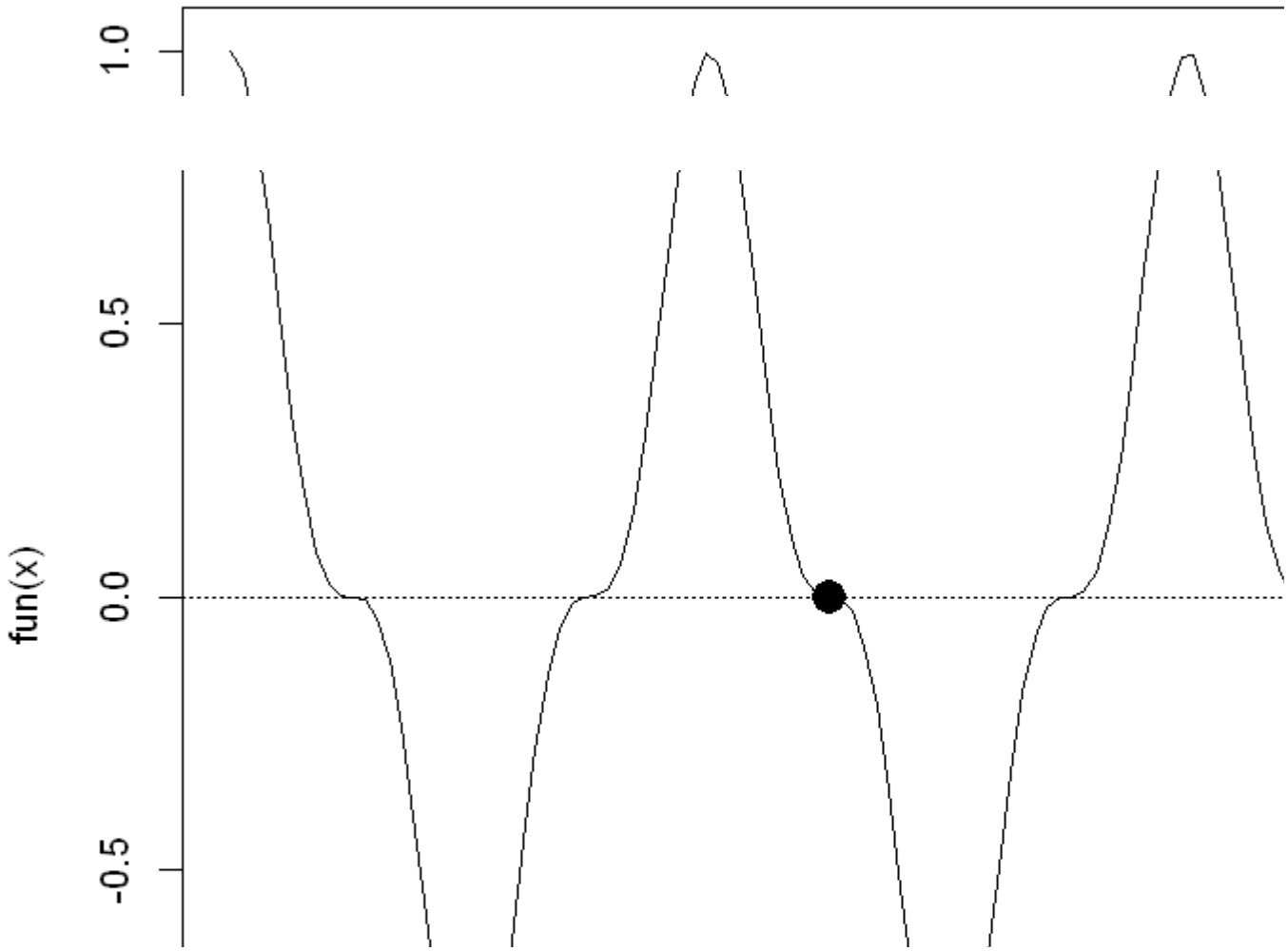
```
N = (I - T) - 1
N
```

A matrix: 3 × 3 of type dbl

0 -1 -1

Question:9. Find the root of the equation f(x) = cos(2x)^3 in the interval [0, 8]. And draw the function c

```
fun = function (x){ cos(2*x)^3}
curve(fun(x), 0, 8)
abline(h = 0, lty = 3)
uni <- uniroot(fun, c(0, 8))$root
points(uni, 0, pch = 16, cex = 2)
```


1.0
0.5
0.0
-0.5
fun(x)