Practical 1

Calculate the dominant eigenvalue and corresponding eigenvector of following matrix using Power method

$$\begin{bmatrix} 1 & 2 & 0 \\ -2 & 1 & 2 \\ 1 & 3 & 1 \end{bmatrix}$$

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Method

We will use power method , in which first of all we take a matrix with entry *1,1,1* as initial eigeenvector then further multiply this with the matrix and we will get an another 3×1 matrix then we will divide each element of the obtained matrix by maximum of that matrix , then we will repeat same till we get a reliable estimate , and we can further calculate dominant eigenvector by

$$\lambda = \frac{A \times x.x}{x.x}$$

Workout

First of all we need to put the matrix in R

```
rm(list=ls())
B<-matrix(c(1,2,0,-2,1,2,1,3,1),ncol=3,byrow=1)
a<-matrix((rep(1,3)),ncol=1)
print(B)
```

```
##      [,1] [,2] [,3]
## [1,]    1    2    0
## [2,]   -2    1    2
## [3,]    1    3    1
```

```
print(a)
```

```
##      [,1]
## [1,]    1
## [2,]    1
## [3,]    1
```

Define two datatype as following

```
temp2<-a
i<-0                          #To store the number of iterations
```

Now doing iterations to calculate eigenvalue

```r
repeat
{
  temp1 <- B %*% a
  temp1 <- temp1/max(temp1)             #dividing by the maximum
  temp1<- round(temp1,4)                #rounding upto 4 decimal places
  i<- i+1                               #Increasing i to count iteration
  cat( "\t",i,"  Iteration"," \t ")
  cat(temp1 ,"\n ")
  a <- temp1
  if(all(temp2[1:3]==temp1[1:3]))       #checking condition to stop iteration
    break
  temp2<-temp1
}
```

```
##   1   Iteration       0.6 0.2 1
##       2   Iteration       0.4545 0.4545 1
##       3   Iteration       0.4839 0.5484 1
##       4   Iteration       0.5052 0.5051 1
##       5   Iteration       0.5017 0.4949 1
##       6   Iteration       0.4994 0.4994 1
##       7   Iteration       0.4998 0.5006 1
##       8   Iteration       0.5001 0.5001 1
##       9   Iteration       0.5 0.4999 1
##       10   Iteration      0.5 0.5 1
##       11   Iteration      0.5 0.5 1
##
```

Now calculating and printing eigenvalue of the eigenvector we got in 11 iteration

```r
cat("\t Dominant eigenvalue is ", sum((B %*% temp1) * temp1)/sum( temp1 * temp1))
```

```
##   Dominant eigenvalue is  3
```

Conclusion

After 11 iteration we got eigenvalue and eigenvector

$$eigenvector = \left[0.5, 0.5, 1\right]^T \qquad eigenvalue = 3$$