Practical 2

Do the LU decomposition of following matrix

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

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Method

First of all we will create a function using *rlu()* to calculate L the lower factor and then use $U = L^{-1}A$ to calculate U , the upper factor

Workout

First of all we need to put the matrix in R

```
rm(list=ls())
A=matrix(c(1,1,-1,1,-2,3,2,3,1),ncol=3,byrow=T)
```

Here creating *rlu()* to take a matrix as input

```
rlu=function(x)
{
if(is.matrix(x)==1)
{
for(i in 2:nrow(x))
{
x[i, ]<-x[i, ]-x[i,1]*(x[1, ]/x[1,1])
}
x[-1,-1]<-rlu(x[-1,-1])
}
x
}
```

Now calculating lower factor by rlu function, uaing our matrix A as input

```
L=rlu(A)
L=round(L,4)
print(L)

##      [,1] [,2]    [,3]
## [1,]    1    1 -1.0000
## [2,]    0   -3  4.0000
## [3,]    0    0  4.3333
```

Now calculating Upper factor

```
U=solve(L)%*%A
U=round(U,4)
print(U)
```

```
##        [,1]   [,2]    [,3]
## [1,] 1.1795 0.1026 -0.0769
## [2,] 0.2821 1.5898 -0.6923
## [3,] 0.4615 0.6923  0.2308
```

Checking the factorization using $A = L \times U$

```
print(L%*%U,digits=1)
```

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

Conclusion

So A ,U ,L are

$$A = \begin{bmatrix} 1 & 1 & -1 \\ 1 & -2 & 3 \\ 2 & 3 & 1 \end{bmatrix} \quad L = \begin{bmatrix} 1 & 1 & -1 \\ 0 & -3 & 4 \\ 0 & 0 & 4.3333 \end{bmatrix} \quad U = \begin{bmatrix} 1.1795 & 0.1026 & -0.0769 \\ 0.2821 & 1.5898 & -0.6923 \\ 0.4615 & 0.6923 & 0.2308 \end{bmatrix}$$