Chapter 5 Lab Part II

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```
library(pander)
library(knitr)
source("adjoint.R")
ls()
```

```
## [1] "adjoint"  "cofactor" "minor"
```

5.

5.5

$\begin{bmatrix} 0 & 0 & 0 & 3 \\ 0 & 0 & 7 & 0 \\ 0 & 4 & 0 & 0 \\ 5 & 0 & 0 & 0 \end{bmatrix}$ 의 역행렬?

```
source("adjoint.R")
A <- matrix(c(0, 0, 0, 5, 0, 0, 4, 0, 0, 7, 0, 0, 3, 0, 0, 0), 4)
det(A)
```

```
## [1] 420
```

```
adjoint(A)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    0    0    0   84
## [2,]    0    0  105    0
## [3,]    0   60    0    0
## [4,]  140    0    0    0
```

```
solve(A)
```

```
##           [,1]      [,2] [,3] [,4]
## [1,] 0.0000000 0.0000000 0.00  0.2
## [2,] 0.0000000 0.0000000 0.25  0.0
## [3,] 0.0000000 0.1428571 0.00  0.0
## [4,] 0.3333333 0.0000000 0.00  0.0
```

5.6

(a) $\begin{bmatrix} 1 & 0 & 6 & 8 \\ 0 & 1 & 5 & 4 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix}$

```
B <- matrix(c(1, 0, 0, 0, 0, 1, 0, 0, 6, 5, -1, 0, 8, 4, 0, -1), 4)
det(B)
```

```
## [1] 1
```

```
B %*% B
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    0    0    0
## [2,]    0    1    0    0
## [3,]    0    0    1    0
## [4,]    0    0    0    1
```

```
adjoint(B)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    0    6    8
## [2,]    0    1    5    4
## [3,]    0    0   -1    0
## [4,]    0    0    0   -1
```

```
solve(B)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    0    6    8
## [2,]    0    1    5    4
## [3,]    0    0   -1    0
## [4,]    0    0    0   -1
```

(b) $\begin{bmatrix} a & b & c \\ 0 & d & e \\ 0 & 0 & f \end{bmatrix}$

$\frac{1}{adf}\begin{bmatrix} df & -bf & be-cd \\ 0 & af & -ae \\ 0 & 0 & ad \end{bmatrix}$

5.7

$$A = \begin{bmatrix} 6 & -1 & 4 \\ 2 & 5 & -3 \\ 1 & 1 & 2 \end{bmatrix}$$

(a) A^t 의 역행렬, A^{-1} 의 전치행렬

```
(A2 <- matrix(c(6, 2, 1, -1, 5, 1, 4, -3, 2), 3))
```

```
##      [,1] [,2] [,3]
## [1,]    6   -1    4
## [2,]    2    5   -3
## [3,]    1    1    2
```

```
t(A2)
```

```
##      [,1] [,2] [,3]
## [1,]    6    2    1
## [2,]   -1    5    1
## [3,]    4   -3    2
```

```
det(A2)
```

```
## [1] 73
```

```
adjoint(A2)
```

```
##      [,1] [,2] [,3]
## [1,]   13    6  -17
## [2,]   -7    8   26
## [3,]   -3   -7   32
```

```
adjoint(A2)/det(A2)
```

```
##             [,1]        [,2]       [,3]
## [1,]  0.17808219  0.08219178 -0.2328767
## [2,] -0.09589041  0.10958904  0.3561644
## [3,] -0.04109589 -0.09589041  0.4383562
```

```
solve(t(A2))
```

```
##             [,1]        [,2]        [,3]
## [1,]  0.17808219 -0.09589041 -0.04109589
## [2,]  0.08219178  0.10958904 -0.09589041
## [3,] -0.23287671  0.35616438  0.43835616
```

```
t(solve(A2))
```

```
##             [,1]        [,2]        [,3]
## [1,]  0.17808219 -0.09589041 -0.04109589
## [2,]  0.08219178  0.10958904 -0.09589041
## [3,] -0.23287671  0.35616438  0.43835616
```

(b) A^{-1} 의 역행렬

```
solve(solve(A2))
```

```
##      [,1] [,2] [,3]
## [1,]    6   -1    4
## [2,]    2    5   -3
## [3,]    1    1    2
```

5.8

(a) $A\vec{x} = \vec{b}, A = \begin{bmatrix} 3 & 4 & -2 \\ -1 & -1 & 3 \\ 1 & -7 & -1 \end{bmatrix}, \vec{b} = \begin{bmatrix} 4 \\ 6 \\ -2 \end{bmatrix}.$

```
(A3 <- matrix(c(3, -1, 1, 4, -1, -7, -2, 3, -1), 3))
```

```
##      [,1] [,2] [,3]
## [1,]    3    4   -2
## [2,]   -1   -1    3
## [3,]    1   -7   -1
```

```
(b3 <- c(4, 6, -2))
```

```
## [1]  4  6 -2
```

```
det(A3)
```

```
## [1] 58
```

```
adjoint(A3)
```

```
##      [,1] [,2] [,3]
## [1,]   22   18   10
## [2,]    2   -1   -7
## [3,]    8   25    1
```

```
adjoint(A3) %*% matrix(b3, ncol = 1)
```

```
##      [,1]
## [1,]  176
## [2,]   16
## [3,]  180
```

```
adjoint(A3) %*% matrix(b3, ncol = 1)/det(A3)
```

```
##           [,1]
## [1,] 3.0344828
## [2,] 0.2758621
## [3,] 3.1034483
```

```
solve(A3) %*% matrix(b3, ncol = 1)
```

```
##           [,1]
## [1,] 3.0344828
## [2,] 0.2758621
## [3,] 3.1034483
```

```
solve(A3, b3)
```

```
## [1] 3.0344828 0.2758621 3.1034483
```

(b) $A\vec{x} = \vec{b}, A = \begin{bmatrix} 3 & 4 & 0 \\ 1 & 0 & 7 \\ -2 & -3 & -8 \end{bmatrix}, \vec{b} = \begin{bmatrix} 2 \\ -8 \\ -11 \end{bmatrix}.$

```
(A4 <- matrix(c(-3, 1, -2, 4, 0, -3, 0, 7, -8), 3))
```

```
##      [,1] [,2] [,3]
## [1,]   -3    4    0
## [2,]    1    0    7
## [3,]   -2   -3   -8
```

```
(b4 <- c(2, -8, -11))
```

```
## [1]   2  -8 -11
```

```
det(A4)
```

```
## [1] -87
```

```
adjoint(A4)
```

```
##      [,1] [,2] [,3]
## [1,]   21   32   28
## [2,]   -6   24   21
## [3,]   -3  -17   -4
```

```
adjoint(A4) %*% matrix(b4, ncol = 1)
```

```
##      [,1]
## [1,] -522
## [2,] -435
## [3,]  174
```

```
adjoint(A4) %*% matrix(b4, ncol = 1)/det(A4)
```

```
##      [,1]
## [1,]    6
## [2,]    5
## [3,]   -2
```

```
solve(A4) %*% matrix(b4, ncol = 1)
```

```
##      [,1]
## [1,]    6
## [2,]    5
## [3,]   -2
```

```
solve(A4, b4)
```

```
## [1]  6  5 -2
```

(c) $A\vec{x} = \vec{b}, A = \begin{bmatrix} 2 & 0 & 8 & -1 \\ 0 & 8 & 0 & -3 \\ 0 & 0 & 4 & \frac{3}{2} \\ 0 & 0 & 0 & \frac{3}{8} \end{bmatrix}, \vec{b} = \begin{bmatrix} 0 \\ -4 \\ 42 \\ 7\frac{1}{2} \end{bmatrix}.$

```
(A5 <- matrix(c(2, 0, 0, 0, 0, 8, 0, 0, 8, 0, 4, 0, -1, -3, 3/2, 3/8), 4))
```

```
##      [,1] [,2] [,3]   [,4]
## [1,]    2    0    8 -1.000
## [2,]    0    8    0 -3.000
## [3,]    0    0    4  1.500
## [4,]    0    0    0  0.375
```

```
(b5 <- c(0, -4, 42, 7.5))
```

```
## [1]  0.0 -4.0 42.0  7.5
```

```
det(A5)
```

```
## [1] 24
```

```
adjoint(A5)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]   12    0  -24  128
## [2,]    0    3    0   24
## [3,]    0    0    6  -24
## [4,]    0    0    0   64
```

```
adjoint(A5) %*% matrix(b5, ncol = 1)
```

```
##      [,1]
## [1,]  -48
## [2,]  168
## [3,]   72
## [4,]  480
```

```
adjoint(A5) %*% matrix(b5, ncol = 1)/det(A5)
```

```
##      [,1]
## [1,]   -2
## [2,]    7
## [3,]    3
## [4,]   20
```

```
solve(A5) %*% matrix(b5, ncol = 1)
```

```
##      [,1]
## [1,]   -2
## [2,]    7
## [3,]    3
## [4,]   20
```

```
solve(A5, b5)
```

```
## [1] -2  7  3 20
```

(a) $A\vec{x} = \vec{b}, A = \begin{bmatrix} 1 & 3 & -1 \\ 4 & -1 & 2 \\ 5 & 2 & 1 \end{bmatrix}, \vec{b} = \begin{bmatrix} 7 \\ 8\frac{1}{2} \\ 10 \end{bmatrix}$.

```
(A6 <- matrix(c(1, 4, 5, 3, -1, 2, -1, 2, 1), 3))
```

```
##      [,1] [,2] [,3]
## [1,]    1    3   -1
## [2,]    4   -1    2
## [3,]    5    2    1
```

```
(b6 <- c(7, 8.5, 10))
```

```
## [1]  7.0  8.5 10.0
```

```
det(A6)
```

```
## [1] 0
```

```
# adjoint(A6)
# adjoint(A6) %*% matrix(b6, ncol = 1)
# adjoint(A6) %*% matrix(b6, ncol = 1)/det(A6)
# solve(A6) %*% matrix(b6, ncol = 1)
# solve(A6, b6)
```

자료 저장

```
save.image("chapter_5_lab_II.rda")
```