Solutions to Exercises

Open Source Tools for Intelligent Systems
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```
x <- 123
as.character(x)
```

```
## [1] "123"
```

```
as.logical(x)
```

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

```
x <- 1; y <-2; z <- y; y <- x; x <- z; print(x); print(y)
```

```
## [1] 2
```

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

```
a <-1; b <- 2; c <- -3; c( (-b+sqrt(b^2-4*a*c))/2*a, (-b-sqrt(b^2-4*a*c))/2*a )
```

```
## [1]  1 -3
```

Vectors 1

```
c(1,3,5,7,9,11,13,15)
```

```
## [1]  1  3  5  7  9 11 13 15
```

```
seq(1,15,by=2)
```

```
## [1]  1  3  5  7  9 11 13 15
```

```
(0.5:7.5)*2
```

```
## [1]  1  3  5  7  9 11 13 15
```

```
x <- sqrt(c(1:32,34:100)); c(mean(x),sd(x))
```

```
## [1] 6.724428 2.348305
```

```
x <- 1:10; y <- rep(5,10);
x+y
```

```
##  [1]  6  7  8  9 10 11 12 13 14 15
```

```
x*y
```

```
##  [1]  5 10 15 20 25 30 35 40 45 50
```

Vectors 2

```
x*(x>y)+y*(y>x)  #compute memberwise max
```

```
##  [1]  5  5  5  5  0  6  7  8  9 10
```

```
pmax(x,y)        #or using the function pmax
```

```
##  [1]  5  5  5  5  5  6  7  8  9 10
```

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

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

```
y <- x[-which(x<0)];  y #remove all negative values
```

```
## [1] 2 4 3 6
```

```
y <- x; y[which(x<0)] <- 0; y #set all negative values to zero
```

```
## [1] 2 0 4 3 6 0
```

Vectors 3

```
x <- c('a','b','c',NA,'d','e',NA,'f'); x
```

```
## [1] "a" "b" "c" NA  "d" "e" NA  "f"
```

```
y <- x[-which(is.na(x))]; y
```

```
## [1] "a" "b" "c" "d" "e" "f"
```

```
y[length(y):1]
```

```
## [1] "f" "e" "d" "c" "b" "a"
```

```
x <- c(3,5,2,1,-3,6,7,22); x
```

```
## [1]  3  5  2  1 -3  6  7 22
```

```
sort(x,decreasing=T)
```

```
## [1] 22  7  6  5  3  2  1 -3
```

Matrices 1

```
x <- matrix(1:4,4,4); x
```

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

```
y <- matrix(1:4,4,4, byrow=T); y
```

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

```
y <- t(x); y
```

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

```
x[2,]+y[,3]
```

```
## [1] 5 5 5 5
```

```
cbind(x,y)
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8]
## [1,]    1    1    1    1    1    2    3    4
## [2,]    2    2    2    2    1    2    3    4
## [3,]    3    3    3    3    1    2    3    4
## [4,]    4    4    4    4    1    2    3    4
```

```
rbind(x,y)
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    1    1    1
## [2,]    2    2    2    2
## [3,]    3    3    3    3
## [4,]    4    4    4    4
## [5,]    1    2    3    4
## [6,]    1    2    3    4
## [7,]    1    2    3    4
## [8,]    1    2    3    4
```

Matrices 3

```
x
```

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

```
apply(x,1,sum)
```

```
## [1]  4  8 12 16
```

```
y
```

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

```
apply(y,2,prod)
```

```
## [1]   1  16  81 256
```

Lists 1

```
myList <- list(band=c('radiohead','pixies','arcade fire'),
          tv_series=c('madmen','the wire'),pi=pi); myList
```

```
## $band
## [1] "radiohead"   "pixies"      "arcade fire"
##
## $tv_series
## [1] "madmen"   "the wire"
##
## $pi
## [1] 3.141593
```

```
names(myList) <- c('MUSIC','TV','PI'); names(myList)
```

```
## [1] "MUSIC" "TV"    "PI"
```

Lists 2

```
res1 <- myList[2]; res1
```

```
## $TV
## [1] "madmen"   "the wire"
```

```
res2 <- myList[[2]]; res2
```

```
## [1] "madmen"   "the wire"
```

```
is.list(res1)
```

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

```
is.list(res2)
```

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

Lists 2

```
myList$MUSIC[3] <- 'lcd soundsystem'
myList$TV <- c(myList$TV, 'fargo')
myList <- myList[-3]
myList
```

```
## $MUSIC
## [1] "radiohead"       "pixies"          "lcd soundsystem"
##
## $TV
## [1] "madmen"   "the wire" "fargo"
```

```
iris$Petal.Color <- "red"
iris$Petal.Color[iris$Species=='virginica'] <- "blue"
iris$Petal.Color[iris$Species=='setosa'] <- "purple"
iris$Petal.Color <- as.factor(iris$Petal.Color)
summary(iris)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.300   Min.   :2.000   Min.   :1.000   Min.   :0.100
##  1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##  Median :5.800   Median :3.000   Median :4.350   Median :1.300
##  Mean   :5.843   Mean   :3.057   Mean   :3.758   Mean   :1.199
##  3rd Qu.:6.400   3rd Qu.:3.300   3rd Qu.:5.100   3rd Qu.:1.800
##  Max.   :7.900   Max.   :4.400   Max.   :6.900   Max.   :2.500
##        Species   Petal.Color
##  setosa    :50   blue  :50
##  versicolor:50   purple:50
##  virginica :50   red   :50
##
##
##
```

Data Frames 2

```
subset(iris,subset = (Sepal.Length>5 & Sepal.Width>3))
```

```
##     Sepal.Length Sepal.Width Petal.Length Petal.Width    Species
## 1            5.1         3.5          1.4         0.2     setosa
## 6            5.4         3.9          1.7         0.4     setosa
## 11           5.4         3.7          1.5         0.2     setosa
## 15           5.8         4.0          1.2         0.2     setosa
## 16           5.7         4.4          1.5         0.4     setosa
## 17           5.4         3.9          1.3         0.4     setosa
## 18           5.1         3.5          1.4         0.3     setosa
## 19           5.7         3.8          1.7         0.3     setosa
## 20           5.1         3.8          1.5         0.3     setosa
## 21           5.4         3.4          1.7         0.2     setosa
## 22           5.1         3.7          1.5         0.4     setosa
## 24           5.1         3.3          1.7         0.5     setosa
## 28           5.2         3.5          1.5         0.2     setosa
## 29           5.2         3.4          1.4         0.2     setosa
## 32           5.4         3.4          1.5         0.4     setosa
## 33           5.2         4.1          1.5         0.1     setosa
## 34           5.5         4.2          1.4         0.2     setosa
## 37           5.5         3.5          1.3         0.2     setosa
## 40           5.1         3.4          1.5         0.2     setosa
## 45           5.1         3.8          1.9         0.4     setosa
## 47           5.1         3.8          1.6         0.2     setosa
## 49           5.3         3.7          1.5         0.2     setosa
```

Data Frames 3

```
write.table(iris,'./iris.csv',col.names=T,row.names=F,sep=',');
iris2 <- read.table('./iris.csv',header=T,sep=',');
summary(iris2)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.300   Min.   :2.000   Min.   :1.000   Min.   :0.100
##  1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##  Median :5.800   Median :3.000   Median :4.350   Median :1.300
##  Mean   :5.843   Mean   :3.057   Mean   :3.758   Mean   :1.199
##  3rd Qu.:6.400   3rd Qu.:3.300   3rd Qu.:5.100   3rd Qu.:1.800
##  Max.   :7.900   Max.   :4.400   Max.   :6.900   Max.   :2.500
##        Species   Petal.Color
##  setosa    :50   blue  :50
##  versicolor:50   purple:50
##  virginica :50   red   :50
##
##
##
```