```
> # Problem 1
> x=c(1,2,3,4,5,2,4,3,5,1,2,3,4,5,1,2)
> y=c("Red","Green","Blue","Magenta")
> y[x]
 [1] "Red"     "Green"   "Blue"    "Magenta" NA        "Green"   "Magenta" "Blue"
 [9] NA        "Red"     "Green"   "Blue"    "Magenta" NA        "Red"     "Green"


> # Problem 2
> A <- matrix(c(1,2,3,0,1,4,5,2,4), nrow=3, byrow=TRUE)
> B <- matrix(c(2,3,0,-1,2,5,3,9,2), nrow=3, byrow=TRUE)
> A
     [,1] [,2] [,3]
[1,]    1    2    3
[2,]    0    1    4
[3,]    5    2    4
> B
     [,1] [,2] [,3]
[1,]    2    3    0
[2,]   -1    2    5
[3,]    3    9    2
> C <- A %*% B
> C
     [,1] [,2] [,3]
[1,]    9   34   16
[2,]   11   38   13
[3,]   20   55   18


> # Problem 3
> # (1)
> df <- as.data.frame(state.x77)
> str(df)
'data.frame':   50 obs. of  8 variables:
 $ Population: num  3615 365 2212 2110 21198 ...
 $ Income    : num  3624 6315 4530 3378 5114 ...
 $ Illiteracy: num  2.1 1.5 1.8 1.9 1.1 0.7 1.1 0.9 1.3 2 ...
 $ Life Exp  : num  69 69.3 70.5 70.7 71.7 ...
 $ Murder    : num  15.1 11.3 7.8 10.1 10.3 6.8 3.1 6.2 10.7 13.9 ...
 $ HS Grad   : num  41.3 66.7 58.1 39.9 62.6 63.9 56 54.6 52.6 40.6 ...
 $ Frost     : num  20 152 15 65 20 166 139 103 11 60 ...
 $ Area      : num  50708 566432 113417 51945 156361 ...
> class(df)
[1] "data.frame"
> # (2)
> income4000 <- df$Income[df$Income < 4000]
> length(income4000)
[1] 13
> # (3)
> index_of_highest_income <- which(rank(-df$Income) == 1)
> index_of_highest_income
[1] 2
> rownames(df)[index_of_highest_income]
[1] "Alaska"
```