

MATH411 | Fall 2018 | Homework 1 (Due: Monday in class, 9/17/2018)

Paul Tomosky

9/17/18

Problem 1 (Vector)

Compute $\sum_{i=1}^{100} (i^2 + 4/i)$

```
i = c(1:100)
```

```
total = sum(i^2 + 4/i)
```

```
total
```

Problem 2 (Vector & Function)

Write a function that (1) counts the number of NA's and (2) tells the locations of NA's in a vector. Put the two outcomes into a list, and return the list in your function. Test your function with a vector contains 1, NA, NA, 2, 3, NA, 4, 5.

```
naCount = function(x){  
  xCountNA = (sum(is.na(x)))  
  xListNA = (which(is.na(x)))  
  output = list(xCountNA, xListNA)  
  return (output)  
}  
naCount(c(1, NA, NA, 2, 3, NA, 4, 5))
```

Problem 3 (Vector & Function)

Given a numeric vector x , write a function `subelements` which returns (1) the mean value and (2) the elements of x larger than $\text{mean}(x)$. Put the two outcomes into a list, and return the list in your function. In order to check, try your function with a simple vector $0:9$.

```
subelements = function(x2){  
  average = mean(x2)  
  AboveAverage = x2[x2 > average]  
  Output2 = list(average, AboveAverage)  
  return (Output2)  
}  
subelements(c(0:9))
```

Problem 4 (Matrix)

Solve numerically the following system

$$\begin{cases} 3x + 2y - z = 1 \\ 2x - 2y + 4z = -2 \\ -x + \frac{1}{2}y - z = 0 \end{cases}$$

```
leftSide = matrix(c(3, -2, -1,
```

```
2, -2, 4,
```

```
-1, 0.5, -1), 3, 3, byrow=TRUE)
```

```
colnames(leftSide) = c('X','Y','z' )
```

```
rightSide = c(1, -2, -0)
```

```
solve(leftSide, rightSide)
```

Problem 5 (Matrix & Function)

Create a function `mat(n)` which returns the $n \times n$ matrix, such that $M_{i,i} = 2$, $M_{i+1,i} = M_{i,i+1} = 1$ and 0 elsewhere. Test your function by creating a 5×5 matrix.

```
mat = function(n){  
  
  M = matrix (0, n, n)  
  
  diag(M) = 2  
  
  diag(M[1:(n-1),2:n]) = 1  
  
  diag(M[2:n, 1:(n-1)]) = 1  
  
  return (M)  
  
}  
  
mat(5)
```

Problem 6 (Character & Sampling & Function)

The game Dominion is a card game that uses cards unique to the game. In the basic game, there are 25 kingdom cards, but only 10 will be used in any given game. The names of the cards are listed below. Write an R function called `dominion()` that will randomly sample (without replacement) ten of the 25 card types and write their names to the screen. Show the results of your sample with the seed `set.seed(2018411)`.

Card names: Adventurer, Bureaucrat, Cellar, Chancellor, Chapel, Council Room, Feast, Festival, Laboratory, Library, Market, Militia, Mine, Moat, Money Lender, Remodel, Smithy, Spy, Thief, Throne Room, Village, Witch, Woodcutter, Workshop, and Gardens.

```
dominion = function(x){  
  
  set.seed(2018411)  
  
  cardNames = c('Adventurer', 'Bureaucrat', 'Cellar', 'Chancellor', 'Chapel', 'Council  
Room', 'Feast', 'Festival', 'Laboratory', 'library', 'Market', 'Militia', 'Mine', 'Moat', 'Money  
Lender', 'Remodel', 'Smithy', 'Spy', 'Thief', 'Throne Room', 'Village', 'Witch', 'Woodcutter',  
'Workshop', 'Gardens')  
  
  cardSelection = sample(cardNames, x)  
  
  return(cardSelection)  
}  
  
dominion(10)
```