Chapter 1, Exercise 1

1: Write a routine that declares a one-dimensional array *A* of length 10, reads in the values of the components of *A* from an input file, computes the sum of the components of *A*, and outputs the sum.

2: Write a routine that declares a two-dimensional array *A* with 5 rows and 3 columns, reads in the values of the components of *A* from an input file, computes the row sums and the column sums of *A*.

Mathematica comments

The solutions below use Mathematica commands that extract rows, extract columns, compute row sums, and transposes a matrix. Other languages have similar commands.

Mathematica note: this initial command clears all definitions of variables and prints out the time. It does so in the European fashion:
{year, month, day, hour, minute, second}

In[•]:=
```
x = 0; Remove["Global`*"]; DateList[Date[]]
```

Out[•]=
```
{2020, 2, 18, 17, 39, 24.255890}
```

Solution for problem 1

Mathematica note: The next command joins the path of this notebook with the file you want to import, imports it, and converts the text input to a Mathematica vector. The Import command also causes the file contents to be displayed. The notebook and the txt-file have to be in the same folder for the code to work.

In[•]:=
```
A = Import[FileNameJoin[{NotebookDirectory[], "Avector.txt"}]] // ToExpression
```

Out[•]=
```
{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
```

We now write some simple code to do the summation.

In[•]:=
```
sum = 0;
Do[sum = sum + A[[i]], {i, 1, 10}]
sum
```

Out[•]=
```
55
```

The fancier Mathematica way is

In[•]:=
```
Plus @@ A
```

Out[•]=
```
55
```

Solution for problem 2

In[•]:=
```
input = Import[FileNameJoin[{NotebookDirectory[], "Amatrix.txt"}]]
Amatrix = input // ToExpression
```

Out[•]=
```
{{1, 2, 3, 4, 5, 6, 7, 8, 9, 10},
{2, 3, 4, 5, 6, 7, 8, 9, 10,11},{3, 4, 5, 6, 7, 8, 9, 10,11,12}}
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 \\ 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 & 12 \end{pmatrix}$$

Row 1 is the first element of Amatrix

In[•]:=
```
row1 = Amatrix[[1]]
```

Out[•]=
```
{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
```

Compute the row sum

In[•]:=
```
sum = 0;
Do[sum = sum + row1[[i]], {i, 1, 10}]
sum
```

Out[•]=
```
55
```

We could do the same for the other rows.

In Mathematica, we can do row sums using the Plus command

In[•]:=
```
Plus @@ Amatrix[[1]]
```

Out[•]=
```
55
```

In[•]:=
```
Plus @@ Amatrix[[2]]
```

Out[•]=
```
65
```

In[•]:=
```
Plus @@ Amatrix[[3]]
```

Out[•]=
```
75
```

The following command will compute the row sums

In[•]:=
```
Plus @@@ Amatrix
```

Out[•]=
```
{55, 65, 75}
```

We can compute column sums by first computing the transpose

In[•]:=
```
AmatrixT = Transpose[Amatrix];
AmatrixT // MatrixForm
```

Out[•]//MatrixForm=

$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \\ 4 & 5 & 6 \\ 5 & 6 & 7 \\ 6 & 7 & 8 \\ 7 & 8 & 9 \\ 8 & 9 & 10 \\ 9 & 10 & 11 \\ 10 & 11 & 12 \end{pmatrix}$$

The column sums of Amatrix are the row sums of AmatrixT

In[•]:=
```
Plus @@@ AmatrixT
```

Out[•]=
```
{6, 9, 12, 15, 18, 21, 24, 27, 30, 33}
```