CS005 Introduction to Programming: Matlab

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Review: Swapping two numbers

```
EDU>> HisAge = 25;
EDU>> HerAge = 48;
```

Let us say we have assigned two variables, HisAge and HerAge…

However we realize that we have made a mistake, we gave the wrong ages to the wrong person…

Review: Swapping two numbers

```
EDU>> HisAge = 25;
EDU>> HerAge = 48;

EDU>> HerAge = HisAge;
EDU>> HisAge = HerAge;
```

We can just swap them….

Review: Swapping two numbers

```
EDU>> HisAge = 25;
EDU>> HerAge = 48;

EDU>> HerAge = HisAge;
EDU>> HisAge = HerAge;

EDU>> HerAge
HerAge =
   25
EDU>> HisAge
HisAge =
   25
```

We can just swap them….

NO!

Look at the values…

Review: Swapping two numbers

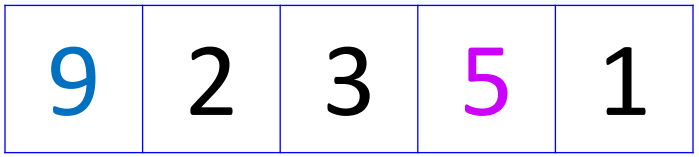
```
EDU>> HisAge = 25;
EDU>> HerAge = 48;

EDU>> Temp = HisAge;
EDU>> HisAge = HerAge;
EDU>> HerAge = Temp;
EDU>>
EDU>> HisAge
HisAge =
   48
EDU>> HerAge
HerAge =
   25
```

We need a temp variable

Swapping two numbers in an array

```
>> KidsAges = [ 9 2 3 5 1 ];
```

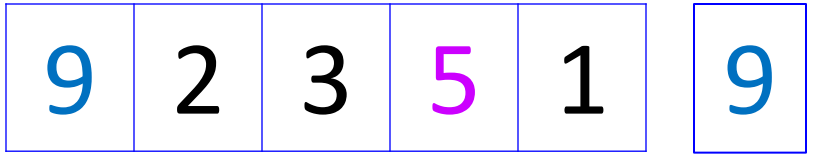



```
% Suppose I want to swap the
% first and forth numbers
```

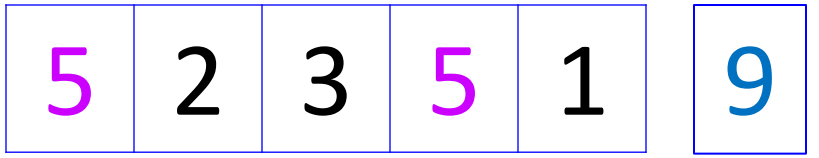
KidsAges

Temp

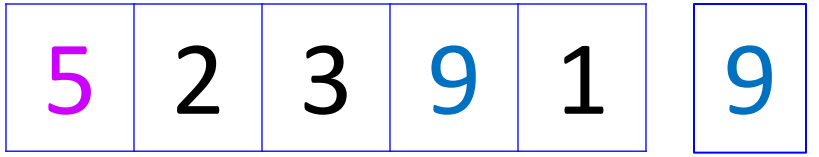
```
>>  Temp = KidsAges(1);
```




```
>>  KidsAges(1) = KidsAges(4);
```




```
>>  KidsAges(4) = Temp;
```

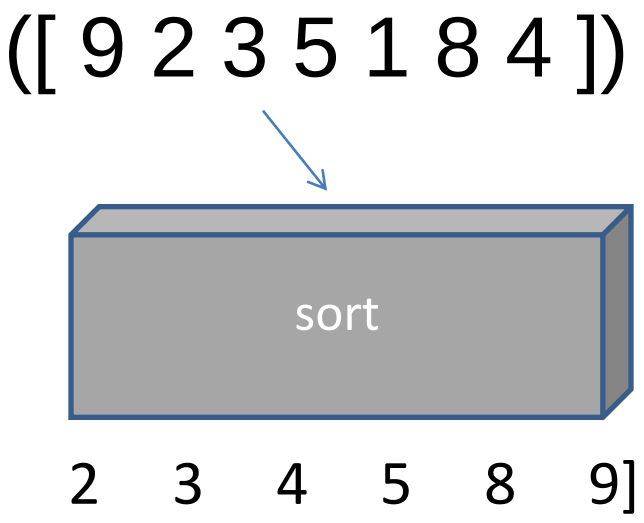


Sorting an Array

```
sort([ 9 2 3 5 1 8 4 ])
ans =
    1    2    3    4    5    8    9
```

```
EDU>> sort('eamonn')
ans =
aemnno
```

There is a built in function that sort arrays (and strings)… However, we will write our own



```
function SortedArray = BubbleSort(A)

for i = 1 : length(A)
   disp(A(i));
end
```

```
EDU>> KidsAges = [ 9 2 3 5 1 8 5 ];
EDU>> BubbleSort(KidsAges)
     9
     2
     3
     5
     1
     8
     5
```

```
function SortedArray = BubbleSort(A)

for i = 1 : length(A) - 1

    if A(i) > A(i+1)
        disp([num2str(A(i)),' and ', num2str(A(i+1)), ' are out of order'])
    end
end
```

9	2	3	5	1	8	5

```
EDU>> KidsAges = [ 9 2 3 5 1 8 5 ];
EDU>> BubbleSort(KidsAges)
9 and 2 are out of order
5 and 1 are out of order
8 and 5 are out of order
```

```
function SortedArray = BubbleSort(A)
 for i = 1 : length(A) - 1
   if A(i) > A(i+1)
     disp(['I swapped ',num2str(A(i)),' and ', num2str(A(i+1))])
     temp = A(i);
     A(i) = A(i+1);
     A(i+1) = temp;
     A
   end
end
```

9	2	3	5	1	8	5

2	3	5	1	8	5	9

```
EDU>> BubbleSort(KidsAges)
I swapped 9 and 2
A =
    2    9    3    5    1    8    5
I swapped 9 and 3
A =
    2    3    9    5    1    8    5
I swapped 9 and 5
A =
    2    3    5    9    1    8    5
I swapped 9 and 1
A =
    2    3    5    1    9    8    5
I swapped 9 and 8
A =
    2    3    5    1    8    9    5
I swapped 9 and 5
A =
    2    3    5    1    8    5    9
```

```
function SortedArray = BubbleSort(A)
for j = 1 :length(A) - 1
    for i = 1 : length(A) - 1
        if A(i) > A(i+1)
                temp = A(i);
                A(i) = A(i+1);
                A(i+1) = temp;
        end
    end
end
SortedArray = A;
```

```
EDU>> BubbleSort(KidsAges)
ans =
    1    2    3    5    5    8    9
```

9	2	3	5	1	8	5

1	2	3	5	5	8	9

```
EDU>> tic  % I am going to lunch
EDU>> toc  % I am back from lunch
Elapsed time is 17.782601 seconds.

EDU>> tic, ReverseArray(KidsAge) , toc
ans =
     8     7     6     5     4     3     2
Elapsed time is 0.001320 seconds.

EDU>> tic, ReverseArray(KidsAge); , toc
Elapsed time is 0.000545 seconds.
```

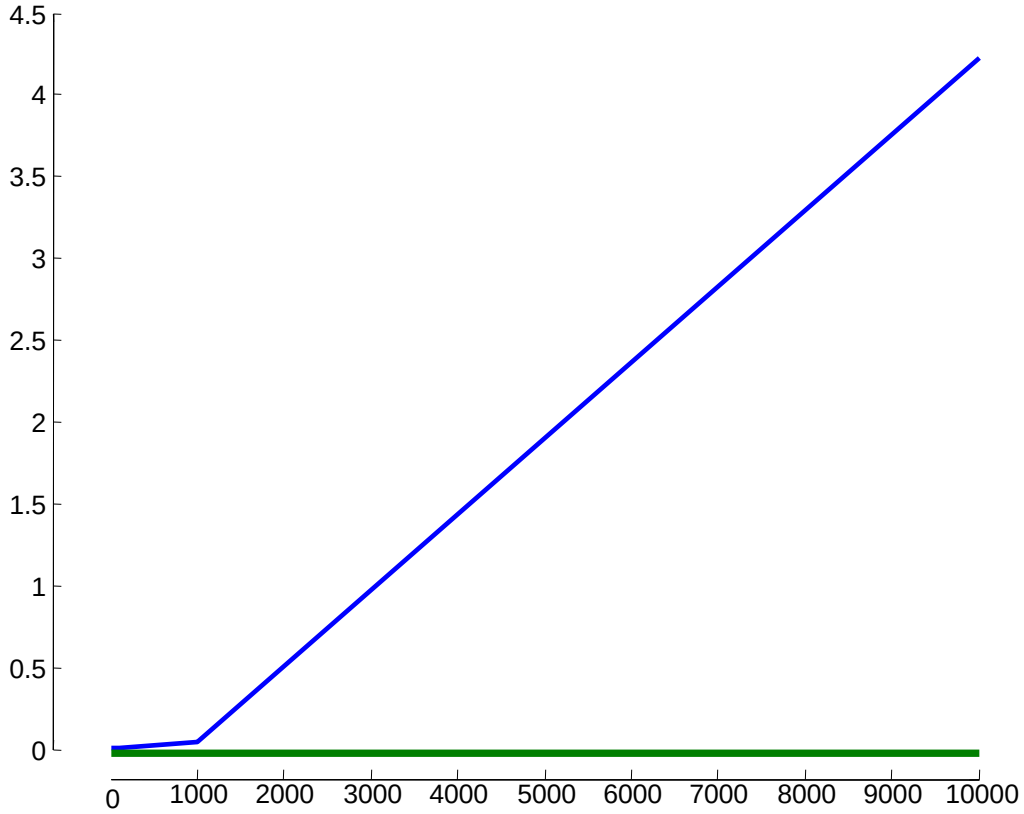
```
EDU>> [1:10]
ans =
    1    2    3    4    5    6    7    8    9   10
EDU>> [10:-1:1]
ans =
   10    9    8    7    6    5    4    3    2    1

EDU>> BubbleSort([10:-1:1])
ans =
    1    2    3    4    5    6    7    8    9   10

EDU>> tic,  BubbleSort([10:-1:1]);  , toc
Elapsed time is 0.000601 seconds.
```

```
EDU>> tic,  BubbleSort([10:-1:1]);  , toc
Elapsed time is 0.000601 seconds.
EDU>> tic, BubbleSort([100:-1:1]);, toc
Elapsed time is 0.002106 seconds.
EDU>> tic, BubbleSort([1000:-1:1]);, toc
Elapsed time is 0.042327 seconds.
EDU>> tic, BubbleSort([10000:-1:1]);, toc
Elapsed time is 4.222284 seconds.
```

```
EDU>> tic, sort([10:-1:1]);, toc
Elapsed time is 0.000027 seconds.
EDU>> tic, sort([100:-1:1]);, toc
Elapsed time is 0.000032 seconds.
EDU>> tic, sort([1000:-1:1]);, toc
Elapsed time is 0.000125 seconds.
EDU>> tic, sort([10000:-1:1]);, toc
Elapsed time is 0.001074 seconds.
```



To sort ten thousand items, bubble sort is about 4,000 times slower than matlabs built-in sort.

Matlabs built-in sort can sort a million numbers in about one tenth of a second, BubbleSort would take 8112 years