Extra Exercise: Java - Solution

1. The following function is defined:

```
public int foo(int[] arr)
{
    int m = arr[0];
    for (int i=0; i<arr.length; i++)
    {
        if (arr[i] > m)
          m = arr[i];
    }
    return m;
}
```

   (a) What will be the returned value of **foo** for the array arr $= [2, -3, 3, 4, -7]$?

   > The function will return 4.

   (b) What operation does the function perform?

   > The function returns the maximum value in the array: it goes over the array element by element using i. If the element in the i-th position is bigger than the previous stored maximum m (which is set to the first element before the loop), than it sets m to equal this element. After the loop finishes it simply returns the value of m.
   >
   > In the case of the above given array, the following values will be calculated:

i	arr[i]	$i > m$?	m
0	2	no	2
1	-3	no	2
2	3	yes	3
3	4	yes	4
4	-7	no	4

   (c) How will the answer change if instead of

```
        if (arr[i] > m)
```

   the code would be

```
        if (arr[i] < m)
```

   ?

   > The function will return the minimum value in the array.

2. The following function is defined:

```
public boolean bar(int n)
{
    if (n < 2 || (n % 2 == 0 && n != 2))
      return false;

    int i = 3;
    while (i < n)
    {
        if (n % i == 0)
            return false;
        i = i + 2;
    }
    return true;
}
```

   Note: the operator || means 'or' (like && is 'and'), and the operator '%' is the modulo operator (i.e. it returns the remainder of the division. For example $3\%2 = 1,\ 4\%2 = 0$).

   (a) What are the returned values of **bar** for the following numbers: $-3, 1, 2, 3, 4, 5, 9, 11, 16$?

n	bar (n)
-3	false
1	false
2	true
3	true
4	false
5	true
9	false
11	true
16	false

(b) Which operation does the function perform?

The function checks whether the input integer n is a prime number. If it is, it returns 'true', and if it isn't it returns 'false'.
The lines

```
if (n < 2 || (n % 2 == 0 && n != 2))
  return false;
```

check if n is either smaller than 2, or an even number that is not 2. If these conditions are met, the function immidiatly returns 'false'. If n is an odd number bigger than 2 (or 2 itself) the function continues to the main loop, where it checks whether n is divisible without remainder for any odd number smaller than itself (why are the odd numbers sufficient?). If this is true for any number (i.e. 9 is divisible by 3 without remainder) it immidiatly returns 'false'. Only if n is not divisible by any number smaller than it will the function return 'true'.

3. The following function is defined:

```
public int baz(int n)
{
    int x = 1;
    for (i=1; i<=n; i++)
    {
        x = x * i;
    }
    return x;
}
```

(a) What are the returned values of **baz** for the following numbers: $1, 2, 3, 4, 5$?
Note: i++ means i = i + 1 (i.e. it increases i by one).

n	baz (n)
1	1
2	2
3	6
4	24
5	120

(b) Which operation does the function perform?

The function returns the factorial of n (mathemtical notation: $n!$).
It does so by multiplying all integers form 1 to n.