Min Max Problem

Find out maximum and minimum elements of an array using minimum number of comparisons.

Write a Java function to find out minimum and maximum in an array. You program should make minimum number of comparisons.

```
int arr[] =
{2,5,50,4,22,44,9,29,49,21,1,36,18,38,58,26,24,42,15,35,25,6,26,46,51,59,11,37,23,43,12,32,52,41,55,8,20,40,60,17,3,57,14,34,54,19,45,7,31,27,47,28,33,53,39,13,48,16,30,10};
```

min = 1

max = 60

Java method **public static int** minmax(**int**[] a) -
return a number of comparisons

{ a[0], a[1], a[2], a[3], a[4], a[5], …… , a[n] }

1. Naive Solution complexity **O(2n)**

Pseudo code

```
// initialization
int   comparisons = 0
int   min =  a[0]
int   max = a[0]

// null & zero length check
comparisons = 1
if (a == null or  length of a < 1)
        return comparisons
```

```
// loop for all elements of the array
loop (from a[1] to a[n])
    comparisons = comparisons +1
    if (a[i] < min)
            min = a[i]

    comparisons = comparisons +1
    if  (a[i] > max)
            max = a[i]
end loop

return comparisons
```

2. Compare in Pairs Solution complexity O(3/2n)

Pseudo code

```
// initialization
int comparisons = 0
// null & zero length check
comparisons = comparisons +1
if (a == null or  length of a < 1)
        return comparisons
// initialization min & max
comparisons = comparisons +1
if ( a[0]>a[1] )
        min = a[1]
        max = a[0]
else
        min = a[0]
        max = a[1]
```

```
//  loop for all elements of the array
loop (i = 2  and  i < length – 1  and  i = i + 2)
        comparisons = comparisons +1
        if (a[i] < a[i+1])
            comparisons = comparisons + 2;
            if(a[i]<min)          min = a[i];
            if(a[i+1]>max)     max = a[i+1];

        else
            comparisons = comparisons + 2;
            if(a[i+1]<min)       min = a[i+1];
            if(a[i]>max)          max = a[i];
end loop
```

```
//  last element of the array check
comparisons = comparisons +1
if ( length is Odd )
    comparisons = comparisons +1
    if ( a[a.length-1] > max )
        max = a[a.length-1]
    else
        comparisons = comparisons +1
        if ( a[a.length-1] < min )
            min = a[a.length-1]

return comparisons
```

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Write 2 methods :

```
public static int minMaxStandard(int []  a)
public static int minMaxPairs(int []  a)
```