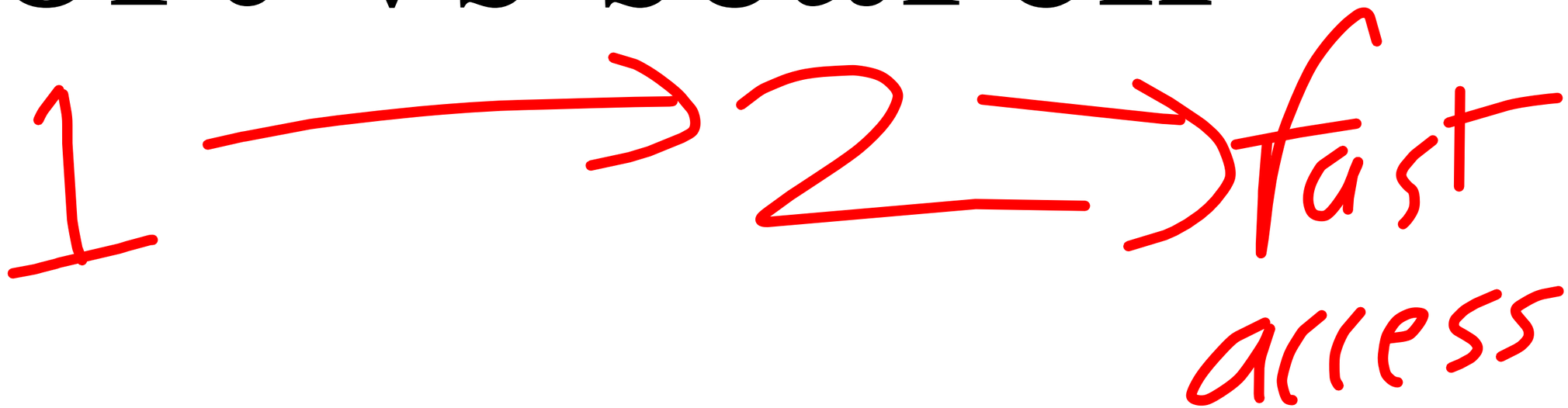
external(data on secondary storage) and internal(ram)

sort vs search

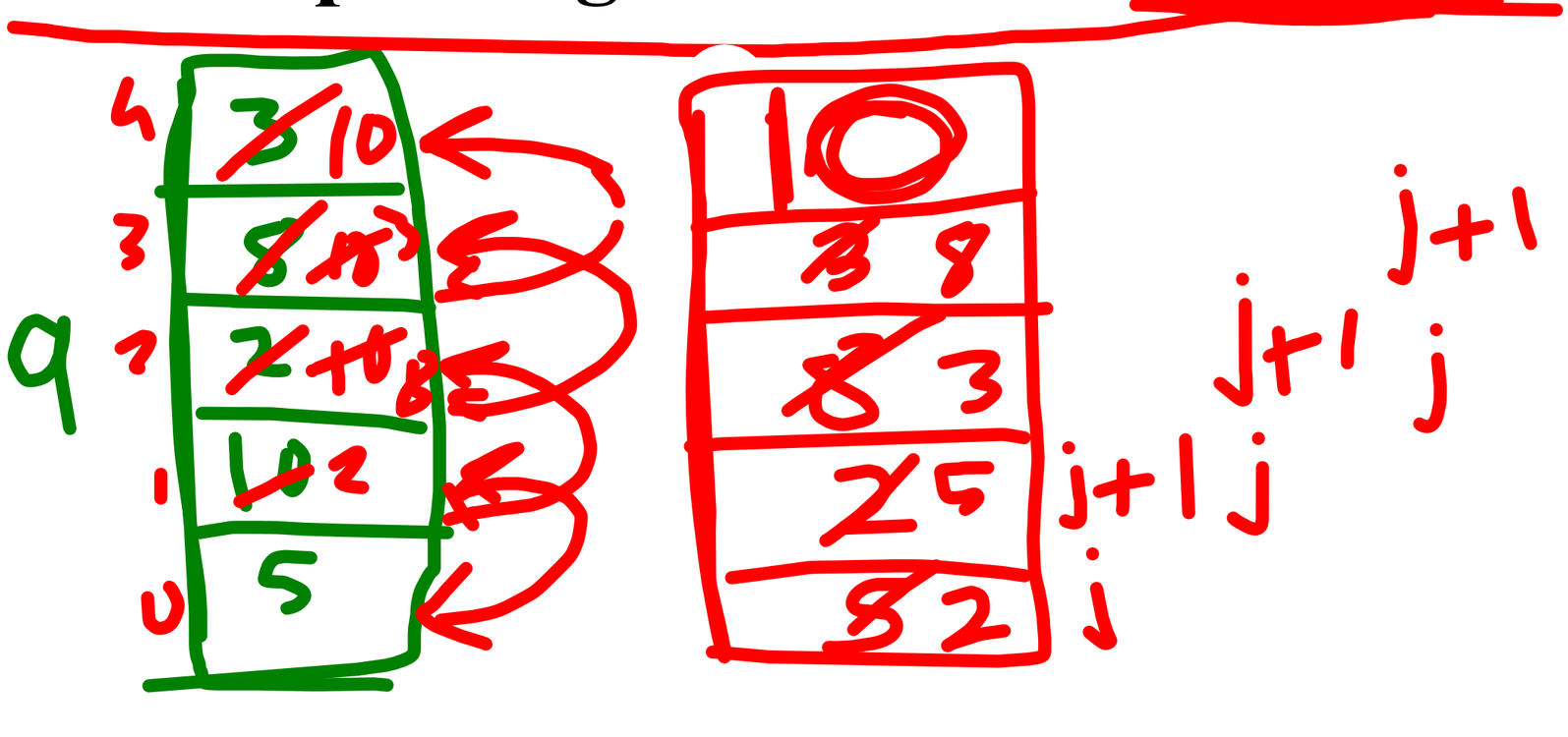


Bubble sort: basic/slowest

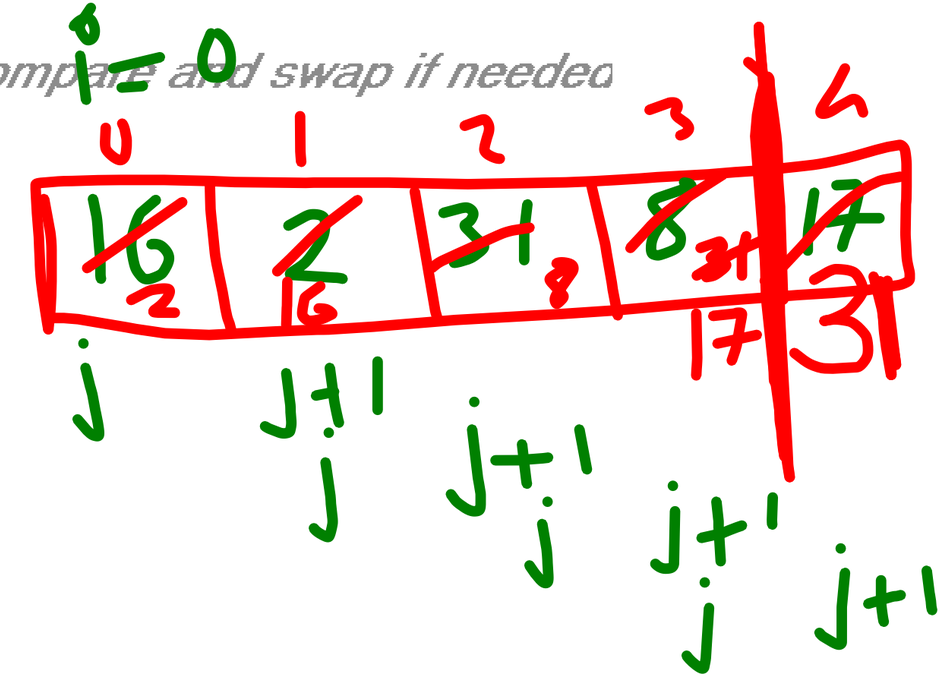
logic:

neighbours are compared with each other and if needed will swap.a[j] compared with a[j+1] if needed swap.

in each pass right element is bubbled on top(length-i)

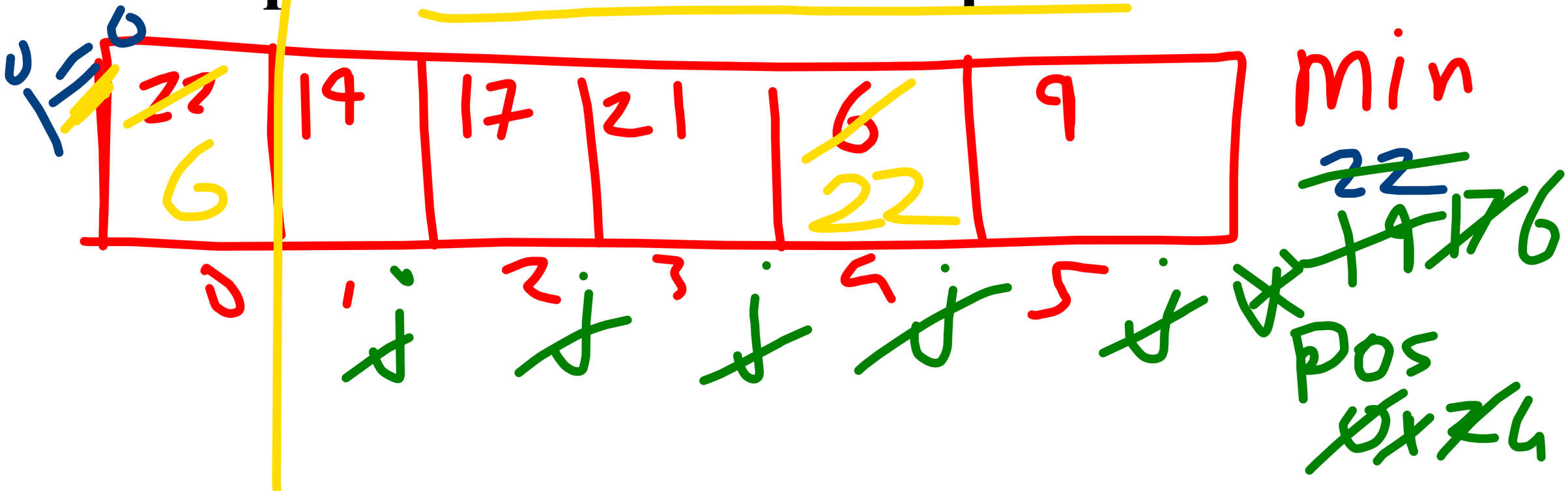


```
for(i=0;i<a.length-1;i++) //given n-1 passes
{
    for(j=0;j<a.length-1;j++) //compare and swap if needed
    {
        if(a[j]>a[j+1])
        {
            temp=a[j];
            a[j]=a[j+1];
            a[j+1]=temp;
        }
    }
}
```

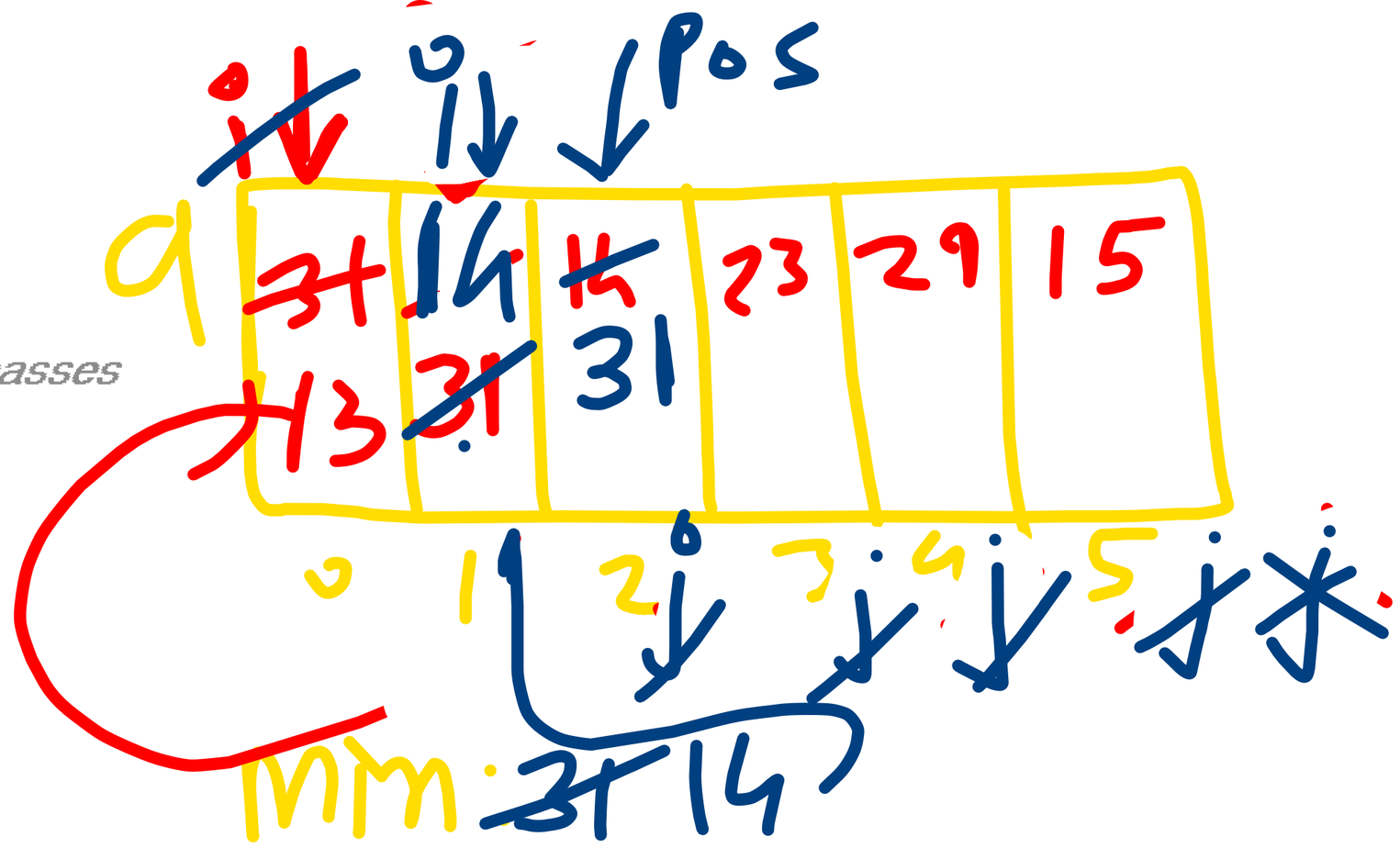


Selection sort:

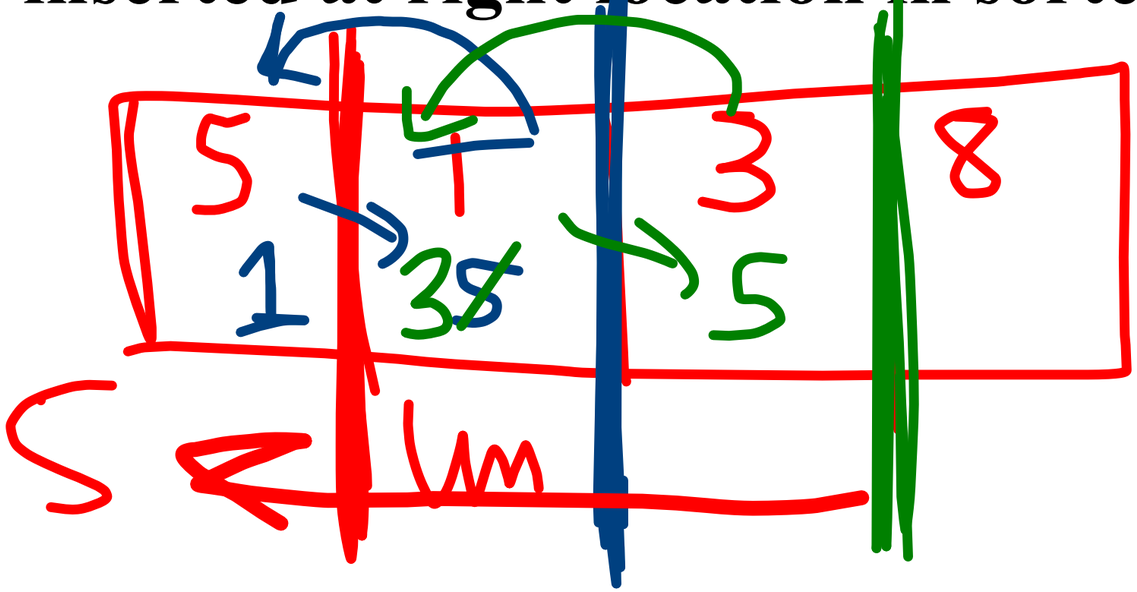
in each pass smallest element is selected and then kept at ith location in ith pass.



```
static void selection_sort(int a[])
{
    int i,j,min,pos;
    for(i=0;i<a.length-1;i++) //given n-1 passes
    {
        min=a[i]; //ref
        pos=i; //ref
        for(j=i+1;j<a.length;j++)
        {
            if(a[j]<min)
            {
            pos=j;
            min=a[j];
            }
        }
        //swap
        a[pos]=a[i];
        a[i]=min;
    }
}
```

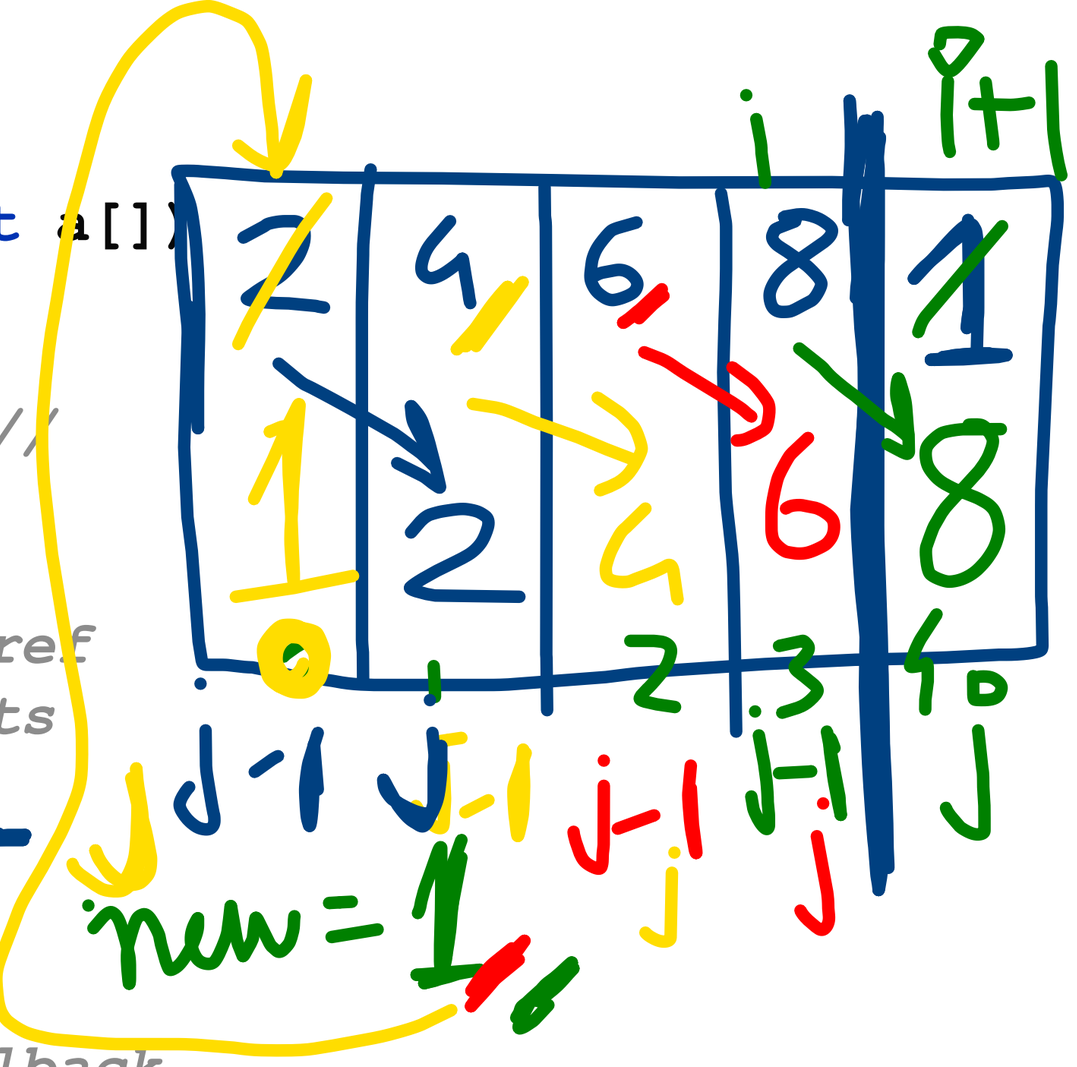


insertion sort:
array is broken in 2 parts
1sorted
2 unsorted
in each pass an element from unsorted side is inserted at right location in sorted part.

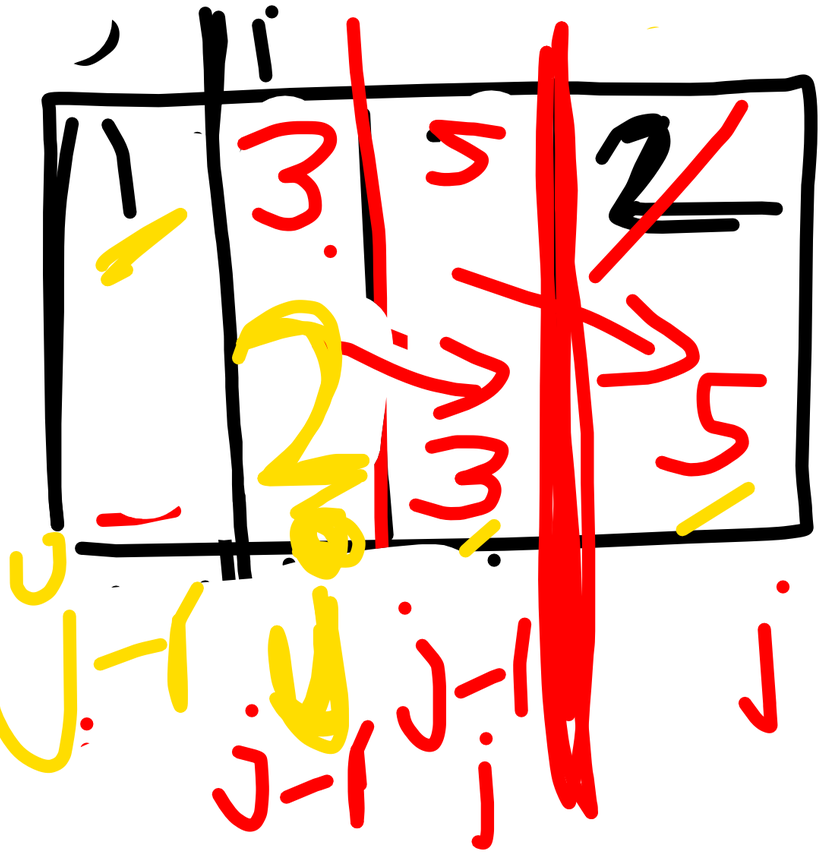


will stop when all element are in sorted part

```
static void insertion_sort(int a[])
{
     int i,j,new_element;
     for(i=0;i<a.length-1;i++)//
given n-1 passes
     {
          new_element=a[i+1];//ref
          j=i+1;//unsorted starts
from
          while(j>0 &&
new_element<a[j-1])
          {
               a[j]=a[j-1];//pullback
               j--;
          }
          a[j]=new_element;
     }
}
```

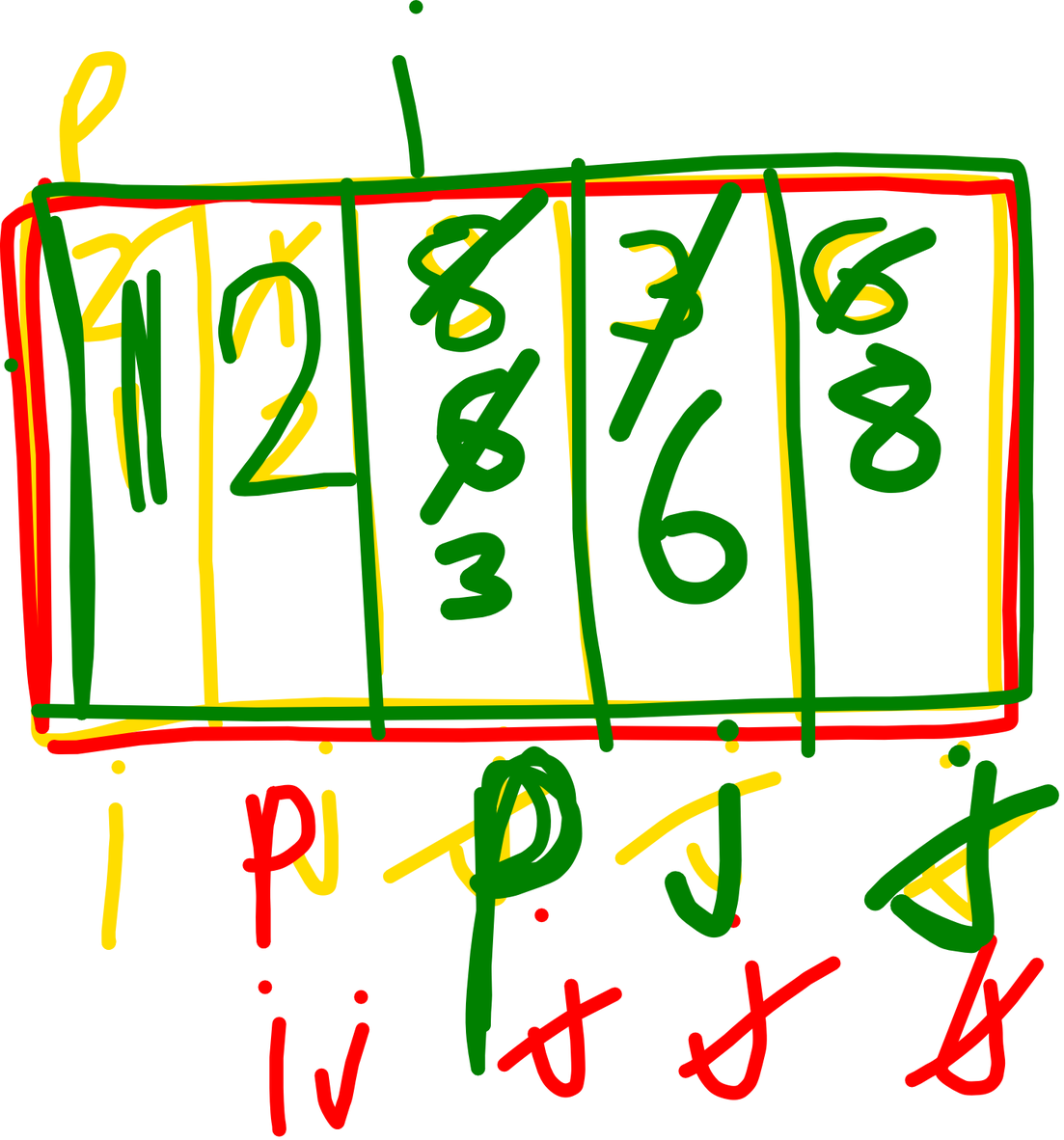


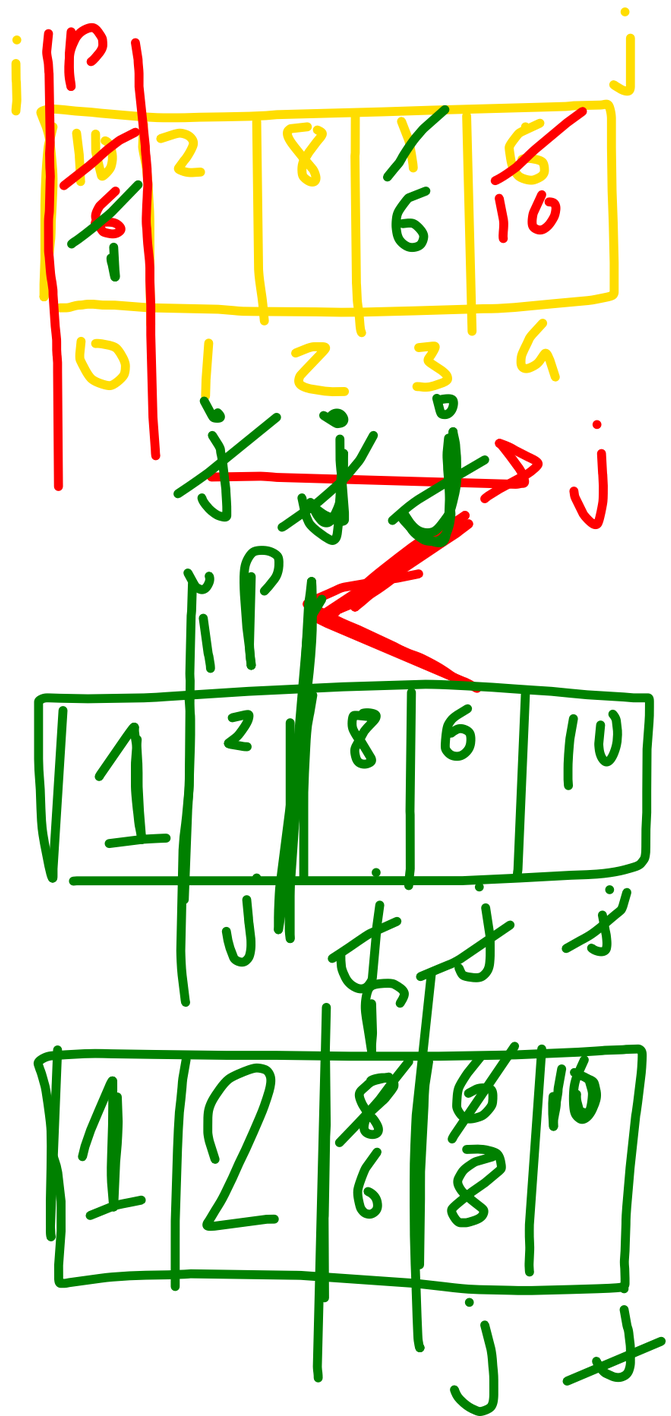
```
static void insertion_sort(int a[])
{
     int i,j,new_element;
     for(i=0;i<a.length-1;i++)//
given n-1 passes
     {
          new_element=a[i+1];//ref
          j=i+1;//unsorted starts
from

          while(j>0 &&
new_element<a[j-1])
          {
               a[j]=a[j-1];//pullback
               j--;
          }
          a[j]=new_element;
     }
}
```

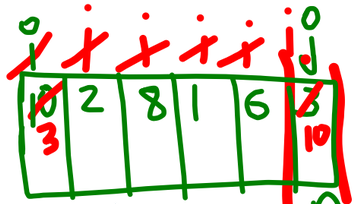


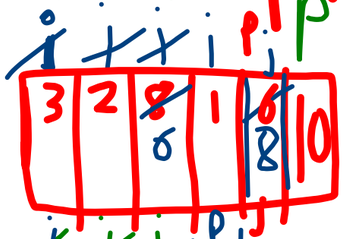
Quick sort
among the fastest sort.
sort from both sides using ref of pivot
pivot is ref either 1st,last,mid
it takes ref of pivot and rearranges everything with ref to pivot

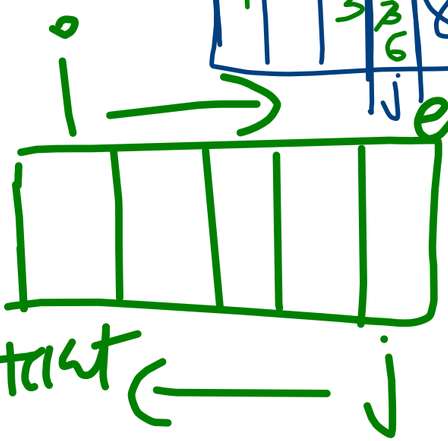
-sorting is done by keeping all lements <pivot before it and all element >=pivot after it



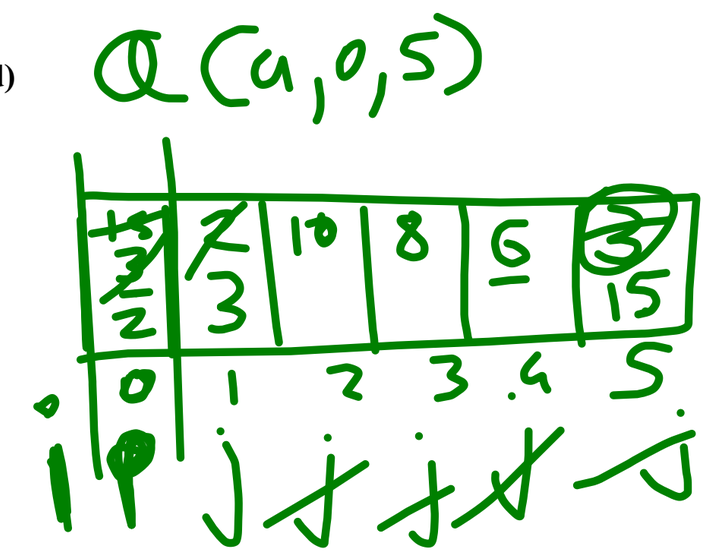


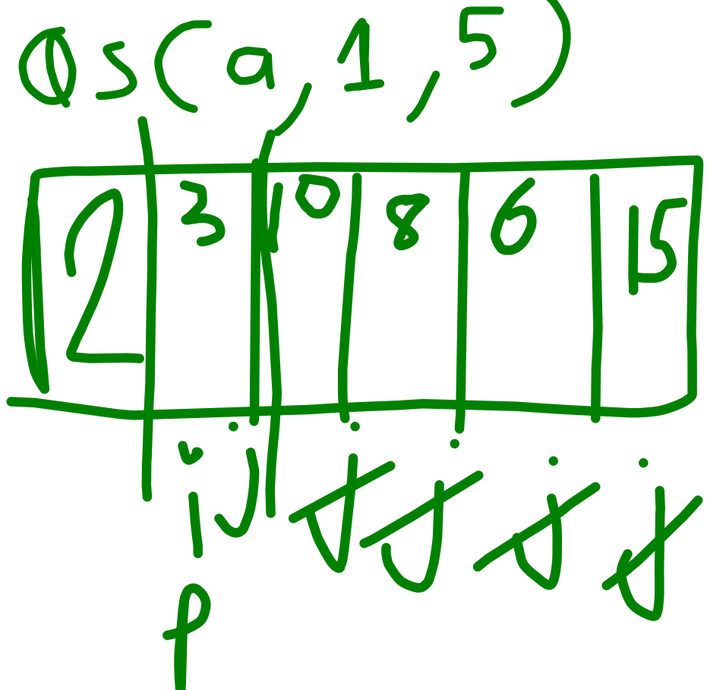




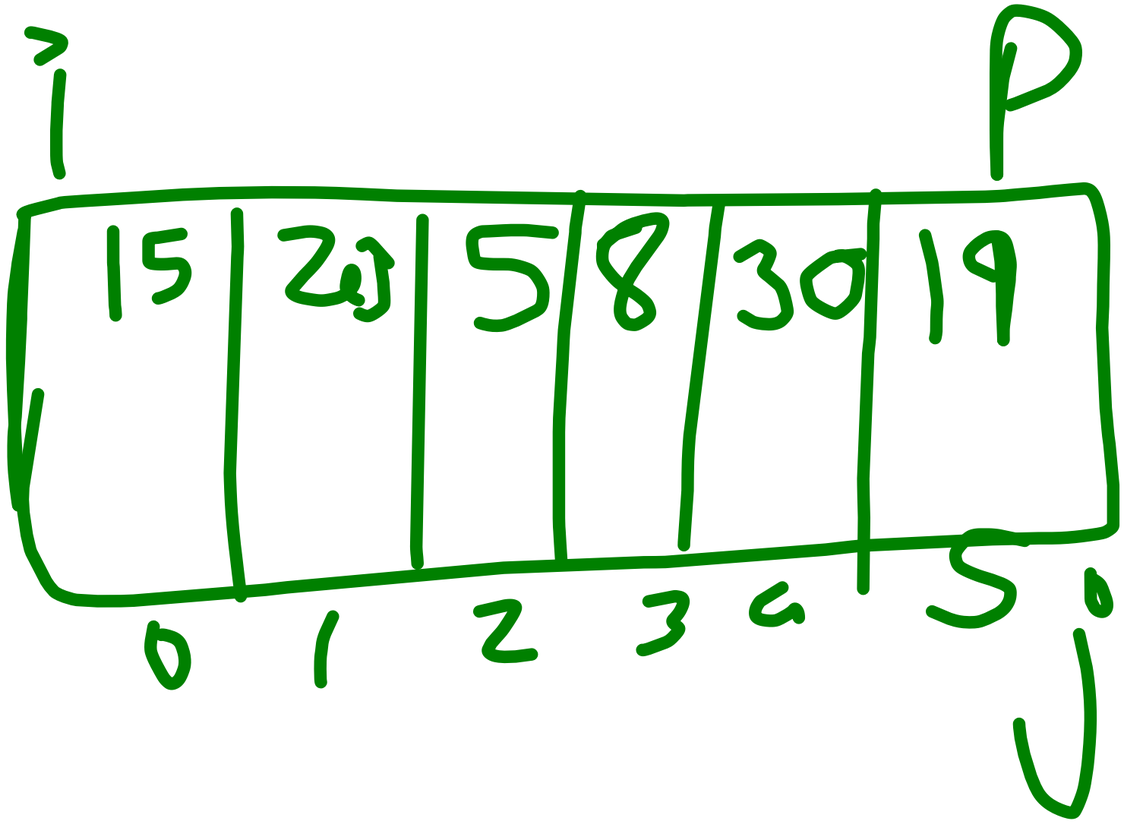


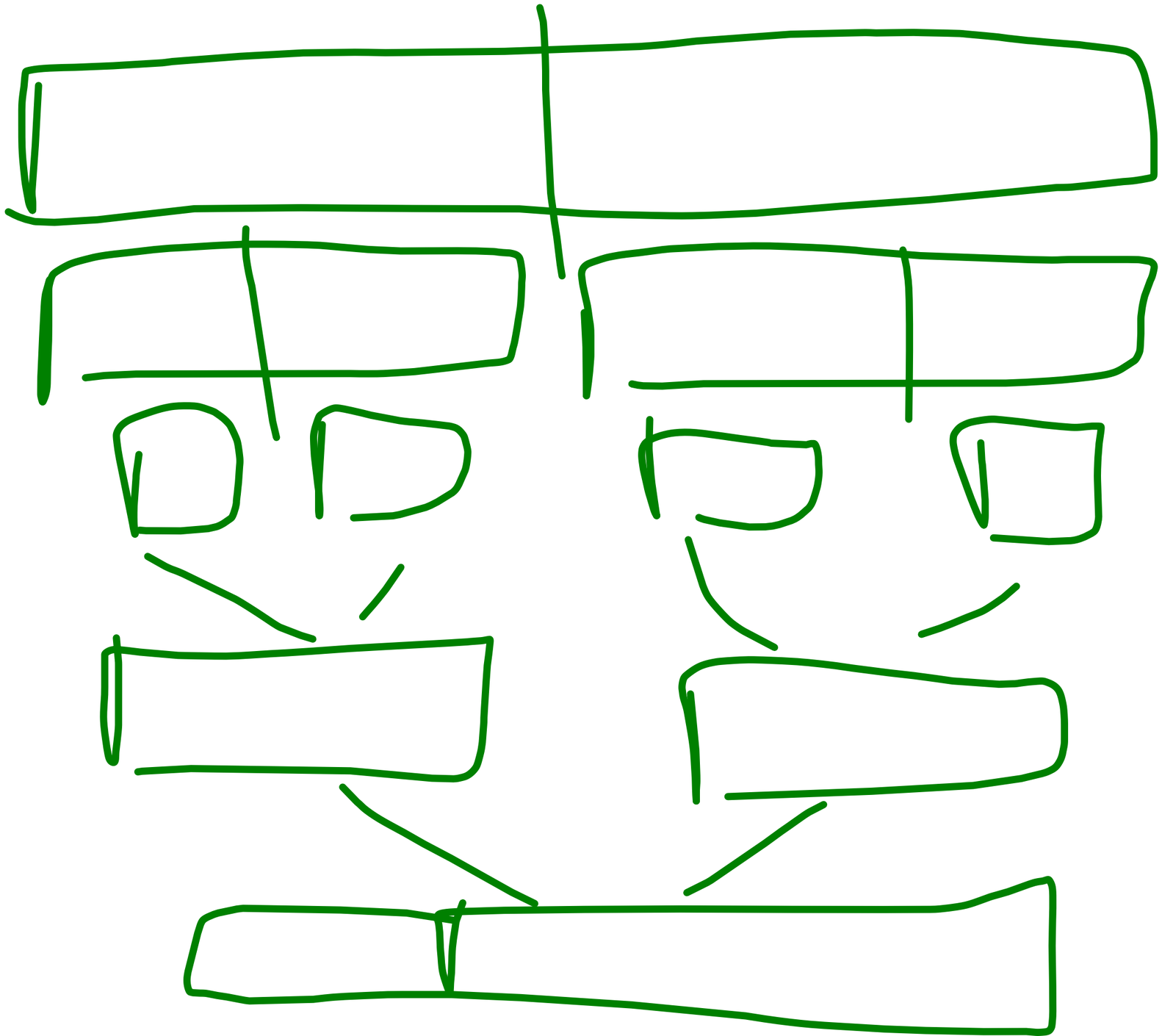

```
void quick_sort(int a[],int start,int end)
{
 int i=start;
int j=end;
int pivot=start;
while(i<j)
{
  while(a[i]<a[pivot])
      i++;
 while(a[j]>a[pivot])
     j--;
if(i<j)
  {
      int temp=a[i];
      a[i]=a[j];
     a[j]=temp;
  }
}
if(i<end)
   quick_sort(a,i+1,end);
if(j>start)
   quick_sort(a,start,j-1);
}
```

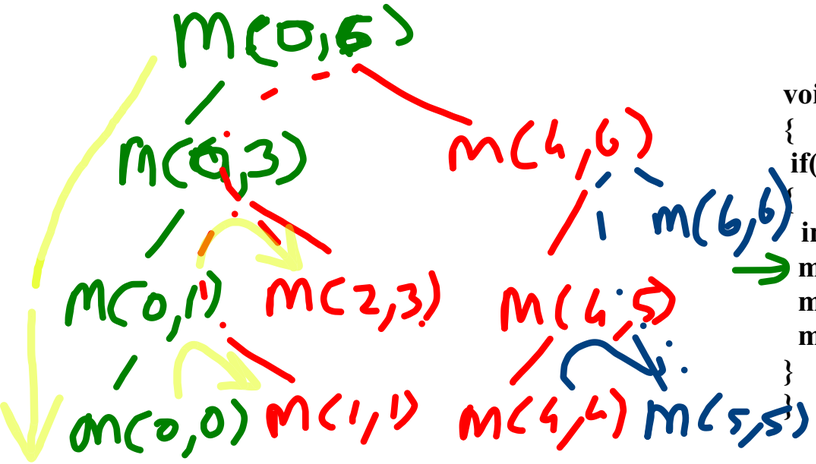




```
void quick_sort(int a[],int start,int end)
{
 int i=start;
int j=end;
int pivot=end;
while(i<j)
{
  while(a[i]<a[pivot])
       i++;
  while(a[j]>a[pivot])
       j--;
 if(i<j)
    {
        int temp=a[i];
        a[i]=a[j];
       a[j]=temp;
    }
}
if(i<end)
    quick_sort(a,i+1,end);
if(j>start)
    quick_sort(a,start,j-1);
}
```

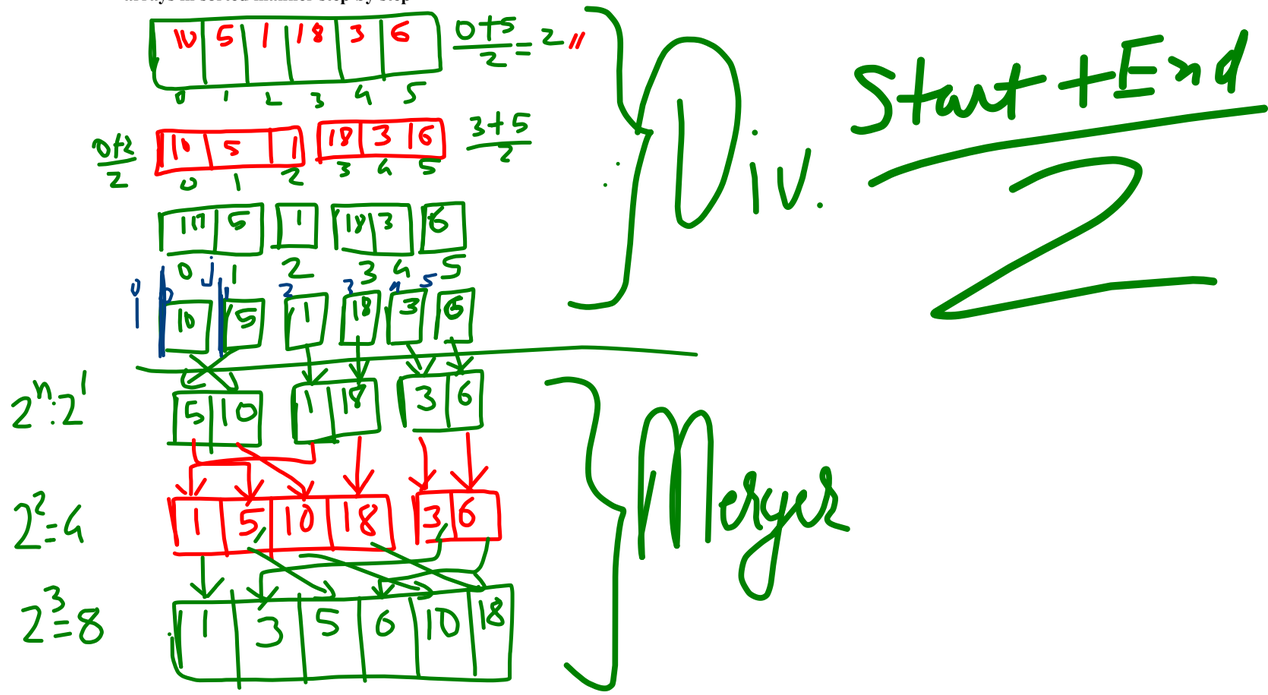


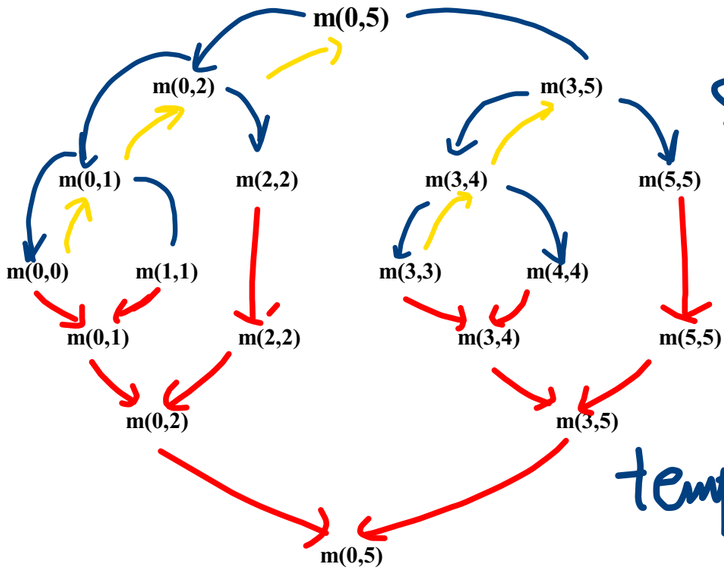


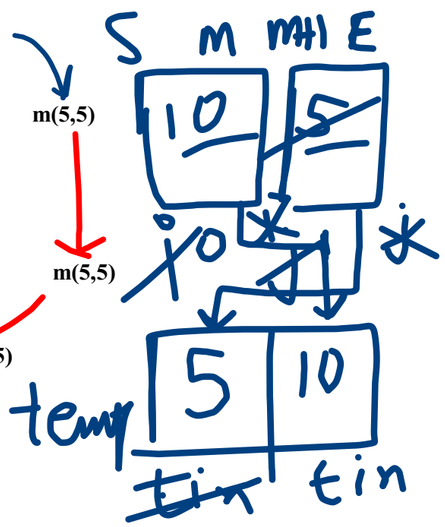


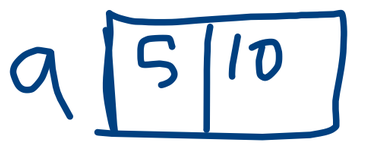

```
void merge_sort(int a[],int start,int end)
{
 if(start<end)
 {
  int mid=(start+end)/2;
  merge_sort(a,start,mid);
  merge_sort(a,mid+1,end);
  merger(a,start,mid,end);
 }
}
```

Merge Sort:
in this we start with 1 array of n elements
divide it from mid again and again till we get n array of size 1. Then merge this arrays in sorted manner step by step










```
void merger(int a[],int start,int mid,int end)
{
int i,j,t[],tindex;
i=start;
j=mid+1;
//temp array to keep sorted data
t=new int(a.length);
tindex=start;
//compare and copy in order
while(i<=mid && j<=end)
{
 if(a[i]<a[j])
     temp[tindex++]=a[i++];
 else
     temp[tindex++]=a[j++];
}
//copy leftover
while(i<=mid)
     tmpe[tindex++]=a[i++];

while(j<=end)
     tmpe[tindex++]=a[j++];

//copy back to a from temp
for(i=start;i<=end;i++)
     a[i]=temp[i];
}
```