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Course: DATA

STRUCTURE

Problem Solving - 2

ii) Implement Merge sort algorithm using C language.

Source Code:-

```
#include <conio.h>
```

```
#include <stdio.h>
```

```
#include <stdlib.h>
```

```
void merge(int arr[], int l, int m, int r);
```

```
void mergeSort(int arr[], int l, int r);
```

```
int main()
```

```
{
```

```
    int n, i, arr-size;
```

```
    printf("\n\nEnter the size of array:");
```

```
    scanf("%d", &n);
```

```
    int arr[n];
```



```
for (i=0; i<n; i++)
```

```
{ printf("\n\t enter the %d element of array",
```

```
scanf("%d", &arr[i]);
```

```
}
```

```
arr_size = sizeof(arr)/sizeof(arr[0]);
```

```
printf("Given array is \n");
```

```
mergeSort(arr, 0, arr_size-1);
```

```
printf("\nSorted array is \n");
```

```
PrintArray(arr, arr_size);
```

```
getch();
```

```
return 0;
```

```
}
```

```
void merge(int arr[], int l, int m, int r)
```

```
{ int i, j, k;
```

```
int n1 = m-l+1;
```

```
int n2 = r-m;
```

```
int L[n1], R[n2];
```



```
for(i=0; i<n1; i++)
```

```
    L[i] = arr[i+1];
```

```
for(j=0; j<n2; j++)
```

```
    R[j] = arr[m+1+j];
```

```
i=0;
```

```
j=0;
```

```
k=1;
```

```
while(i<n1 && j<n2)
```

```
{ if(L[i] <= R[j])
```

```
    { arr[k] = L[i];
```

```
      i++;
```

```
    }
```

```
else {
```

```
    arr[k] = R[j];
```

```
      j++;
```

```
    }
```

```
    k++; }
```

```
while(i<n1) {
```

```
    arr[k] = L[i];
```

```
    i++;
```



```
K++;  
}
```

```
Void mergeSort (int arr[], int l, int r)
```

```
{ if (l < r) {
```

```
    int m = l + (r - l) / 2;
```

```
    mergeSort(arr, l, m);
```

```
    mergeSort(arr, m + 1, r);
```

```
    merge(arr, l, m, r);
```

```
}
```

```
}
```

```
Void PrintArray (int A[], int size)
```

```
{
```

```
    int i;
```

```
    for (i = 0; i < size; i++)
```

```
    {
```

```
        printf ("%d", A[i]);
```

```
        printf ("\n");
```

```
}
```


② Perform Quick Sorting for the following:

34	12	8	11	29	17	5	18	32	46	22
----	----	---	----	----	----	---	----	----	----	----

Algorithm

Step by step manner:-

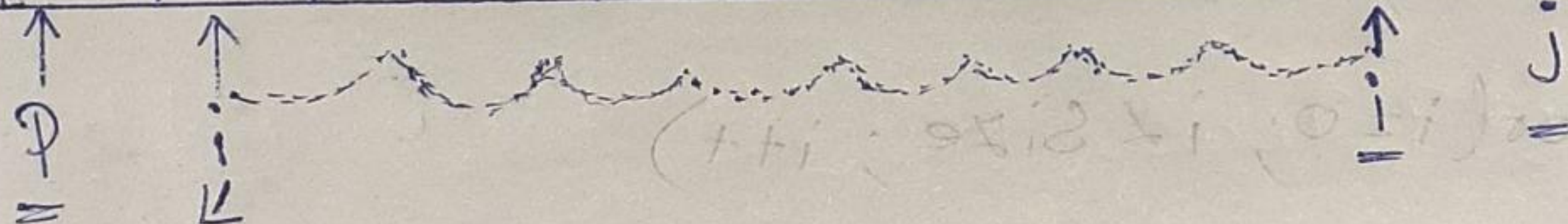
34	12	8	11	29	17	5	18	32	46	22
----	----	---	----	----	----	---	----	----	----	----

P = 34 initial of array;

①

Condition $\rightarrow \underline{i < P}$ & $\underline{j! > P}$

34	12	8	11	29	17	5	18	32	46	22
----	----	---	----	----	----	---	----	----	----	----



$i < P$ & $j! > P$

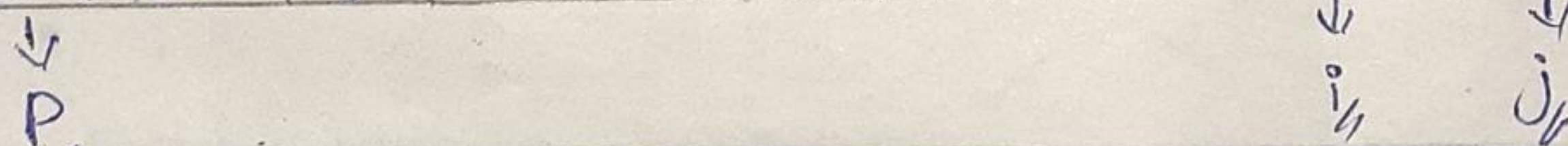
②

34	12	8	11	29	17	5	18	32	46	22
----	----	---	----	----	----	---	----	----	----	----



$i < P$ and $j! > P$ swap i and j

34	12	8	11	29	17	5	18	32	22	46
----	----	---	----	----	----	---	----	----	----	----



③ Condition
arised $\rightarrow \underline{i < P} \ \&\& \ \underline{j > P}$

34	12	8	11	29	17	5	18	32	24	46
----	----	---	----	----	----	---	----	----	----	----

↓
P

↓ ↓
j j

Condition
arised $\rightarrow i \neq P \ \&\& \ j > P$ move j backwards.

34	12	8	11	29	17	5	18	32	24	46
----	----	---	----	----	----	---	----	----	----	----

↓
P

↓ ↓
j j

Condition arised: $\underline{i \neq P \ \&\& \ j > P}$

swap P and j

22	12	8	11	29	17	5	18	32	34	46
----	----	---	----	----	----	---	----	----	----	----

↓ ↓ ↓
P i j

Condition arised: $i < P \ \&\& \ j > P$

22	12	8	11	29	17	5	18	32	34	46
----	----	---	----	----	----	---	----	----	----	----

↓ ↓ ↓ ↓ ↓
P i j j j

Condition $\rightarrow i < P \ \&\& \ j > P$

22	12	8	11	29	17	5	18	32	34	46
----	----	---	----	----	----	---	----	----	----	----

↓ ↓ ↓
P i j

Condition: $i \neq P \ \&\& \ j \neq P : j \& 1 > \text{swapped}$

22	12	8	11	18	17	5	29	32	34	46
↓			↓					↓		
P			i					j		

Condition: $i < P \ \&\& \ j > P : \text{moving } i$

22	12	8	11	18	17	5	29	32	34	46
↓				↓			↓	↓		
P				i			i	j		

Condition: $i \neq P \ \&\& \ j > P$

22	12	8	11	18	17	5	29	32	34	46
↓						↓	↓			
P						j	i			

Condition: $i \neq P \ \&\& \ j \neq P : \text{swap } P \ \& \ j$

5	12	8	11	18	17	22	29	34	46
↓	↓			↓					
P	i			j					

Condition: $i \neq P \ \&\& \ j > P : \text{moving "j" backward}$

5	12	8	11	18	17
↓	↓			↓	
P	i			j	

5	12	8	11	18	17	22	29	32	34	46
↓	↓	↓								
P	j	i								

if the P and j at same point omit it =

5	12	8	11	18	17	22	29	32	34	46
	↓	↓			↓					
	P	i			j					

condition: $i < P \ \&\& \ j > P$: moving "i" forward.

5	12	8	11	18	17	22	29	32	34	46
↓				↓	↓					
P				i	j					

Condition:- $j \neq P \ \&\& \ j > P$

5	12	8	11	18	17	22	29	32	34	46
↓			↓	↓	↓					
P			j	i	j					

Condition:- $i \neq P \ \&\& \ j \neq P$: swap P and j

5	11	8	12	18	17	22	29	32	34	46
↓	↓	↓	↓	↓	↓					
i	P	j		P	i					

Condition: $i \neq P \ \&\& \ j \neq P$ so swap P and j

5 8 11 12 17 18 22 29 32 34 36

Final Sort:-

5	8	11	12	17	18	22	29	32	34	36
---	---	----	----	----	----	----	----	----	----	----