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DSA ASSIGNMENT - Ap19110010457
CSE-F

- ① Take the elements from the user and sort them in descending order and do the following.
 - a. Using binary search find the element location in the array where the element is asked from user.
 - b. Ask the user to enter any two locations, print the sum and product of values at those locations in the sorted array.

```
#include <stdio.h>
int binary_search (int arr[], int a, int b, int n)
{
    if (b >= a)
    {
        int mid = a + (b - a) / 2;
        if (arr[mid] == n)
            return mid;
        if (arr[mid] > n)
            return binary_search (arr, a, mid - 1, n);
        return binary_search (arr, mid + 1, b, n);
    }
    return -1;
}

int main()
{
```

```

int num;
printf("Enter array size:");
scanf("%d", &num);
int i, j, a, val[num], op, var, p1, p2, sum, pro;
for (a=0; a<num; a++)
{
    printf("Enter value: ");
    scanf("%d", &val[a]);
    for (i=0; i<(num)+1; i++)
    {
        for (j=i+1; j<(num); j++)
        {
            if (val[i]<val[j])
            {
                a=val[i];
                val[i]=val[j];
                val[j]=a;
            }
        }
    }
}
printf("Array in Descending order ");
for (i=0; i<num; i++)
{
    printf("%d", val[i]);
}
printf("\nMENU\n");

```

```

printf("1. find value at entered position n");
printf("2. find position of entered element (n)");
printf("3. print sum of product of values of entered location");
scanf("-1.d; &op");
switch (op) {
    case 1:
        printf("Enter position value (index) to obtain element:");
        scanf("-1.d", &val);
        printf("The value at position -1.d is -1.d", var, val[val]);
        break;
    case 2:
        printf("Enter element to find position:");
        scanf("-1.d", &var);
        int result = binary search(val, 0, num-1, var);
        if(result == -1) printf("Element not found");
        else printf("Element found at index -1.d", result);
        return 0;
    case 3:
        printf("Enter two index values:");
        scanf("-1.d-1.d", &p1, &p2);
        sum = val[p1] + val[p2];
        pro = val[p1]*val[p2];
        printf("sum = -1.d \n", sum);
        printf("product = -1.d \n", pro);
        break;
}

```

③ Sort the array using Merge sort where elements are taken from the user and find the product of k^{th} elements from first and last where k is taken from the user.

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

void merge(int arr[], int l, int m, int r)
{
    int i, j, k;
    int n1 = m - l + 1;
    int n2 = r - m;
    /* Create temp arrays */
    int L[n1], R[n2];
    /* Copy data to temp arrays */
    for (i = 0; i < n1; i++)
        L[i] = arr[l + i];
    for (j = 0; j < n2; j++)
        R[j] = arr[m + 1 + j];
    /* Merge the temp arrays back into arr */
    i = 0; /* Initial index of first subarray */
    j = 0; /* Initial index of second subarray */
    k = l; /* Initial index of merged subarray */
    while (i < n1 && j < n2)
    {
        if (L[i] < R[j])
            arr[k] = L[i];
        else
            arr[k] = R[j];
        k++;
        i++;
        j++;
    }
}
```

```
i++;  
else  
arr[k] = R[i];  
j++;  
k++;  
}
```

```
while(i < n2)
```

```
{  
arr[k] = R[i];  
j++;  
k++;  
}
```

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

```
{  
if(l < r)  
{  
int m = l + (r - 1) / 2;  
// Sort first & second halves
```

```
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");
```

```
}
```

```

int main()
{
    int size, v;
    printf("Enter array size:");
    scanf("%d", &size);
    int val[size];
    for (v=0; v<size; v++)
    {
        printf("Enter value:");
        scanf("%d", &val[v]);
    }
    printArray(val, size);
    mergesort(val, 0, size-1);
    printf("sorted array is\n");
    printArray(val, size);
    int k, f, l, p1, p2, temp;
    printf("Enter k value:");
    scanf("%d", &k);
    p1 = p2 = 1;
    for (f=0; f<=k; f++)
    {
        temp = val[f];
        p1 = temp + p1;
    }
    for (l=size-1; l>=k; l--)
    {
        temp = val[l];
        p2 = temp + p2;
    }
    printf("%d %d", p1, p2);
}

```

Q) Discuss insertion sort and selection sort with examples.

Insertion sort works by inserting the values in the existing sorted file. It constructs sorted array while inserting single element at a time. This process continues till array is sorted.

Selection sort performs sorting by searching for the minimum value number and placing it into the first last position according to the order (ascending/descending). The process of searching the minimum key and placing it in the proper position is continued until all the elements are placed at right position.

Advantages

Insertion sort:

- easily implemented and very efficient when used with small data sets.
- Best case complexity: $O(n)$
- faster than other sorting algorithms.
- In-place sorting technique.

Selection sort:

- Easy/simple implementation.
- useful when data set is less
- can be used when memory is less

Example:-

Insertion sort

25 15 30 9 99 20
15 25 30 9 99 20
15 25 30 9 99 20

Selection sort

0 1 2 3 4
1 → 17 16 3 15 6
2 → 3 16 17 15 6
3 → 6 15 17 16 1

4. sort the array using bubble sort where elements are taken from the user and display the elements
- in alternate order.
 - sum of elements in odd positions and product of element in even positions.
 - elements which are divisible by m where m is taken from the user.

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

```
/* Bubble sort */
void bubble sort (int ar[], int n)
{
    int i, j, temp;
    for (i=0; i<n-1; i++)
        for (j=0; j<n-i-1; j++)
            if (ar[j] > ar[j+1]) /* Exchange values */
    {
        temp = ar[j];
        ar[j] = ar[j+1];
        ar[j+1] = temp;
    }
}
int main()
{
    int size, i;
    printf ("Enter size of required array: ");
    scanf ("%d", &size);
    int arr [size];
```

```

for (i=0; i<8; i++)
{
    printf("-1.d", arr[i]);
    printf("\t");
}

printf("\n/* MENU */\n");
printf("1. Display element in alternate order\n");
printf("2. Sum of odd position elements and product
      of even position elements");
printf("\n3. divisible by m\n");

int op, sum=0, product=1, m;
printf("Enter choice: ");
scanf("%d", &op);

switch (op)
{
    case 1:
        for (i=0; i<8; i+=2)
        {
            printf("-1.d\t", arr[i]);
        }
    case 2:
        for (i=0; i<8; i+=2)
        {
            sum = sum + arr[i];
        }
        for (i=1; i<8; i+=2)
        {
            product = product * arr[i];
        }
}

```

product = product * arr[i];

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printf("sum : %d\n", sum);

printf("product : %d\n", product);

Case 3:

printf("Enter Value m: ");

scanf("%d", &m);

printf("Numbers divisible by %d are: %d", m);

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

{

if (arr[i] % m == 0)

{

printf("%d\t", arr[i]);

}

}

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Q) write a recursive program to implement binary search

#include <stdio.h>

int binary search(int a[], int l, int h, int x)

{

int mid = (l+h)/2;

if (l>h)

return -1;

if (a[mid] == x)

return mid;

if (a[mid] < x)

return binary search(a, mid+1, h, x);

else

return binary search(a, l, mid-1, x);

}

int main(void)

{

int a[100], size, pos, val, i;

printf("Enter array size: ");

scanf("%d", &size);

printf("Enter array elements: \n");

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

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

printf("Enter element to search: \n");

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

scanf("%d", &val);

```
pos = binary search(a, 0, size - 1, val);
if (pos < 0)
    printf("can't find element %d in array\n", val);
else
    printf("the position of %d in array is %d\n",
           val, pos + 1);
return 0;
```

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