Course Name: Data Structures and Algorithms Lab
Course code : MCSE501P
Faculty Name: SARAVANAN R – SCOPE

Lab Assessment – 2

List of programs:

6. Write a program in C to convert infix form of an algebraic expression into postfix form using stack. Get the input from the keyboard.
7. Write a program in C to implement the following data structures: Singly linked list, doubly linked list, singly linked circular list, doubly linked circular list. Perform insertion and deletion on these data structures.
8. Write a program in C to perform radix sort
9. Write a program in C to perform insertion sort
10. Write a program in C to perform merge sort
11. Write a program in C to perform selection sort

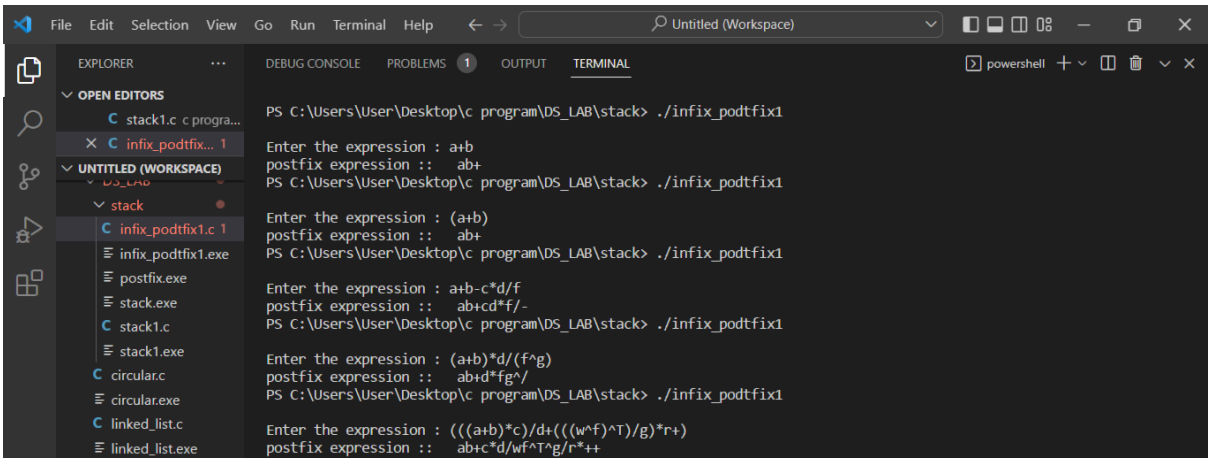
6. Write a program in C to convert infix form of an algebraic expression into postfix form using stack. Get the input from the keyboard.

Program:-

```
#include <limits.h>
#include <stdio.h>
#include <stdlib.h>
#define MAX 20
char stk[20];
int top = -1;
int isEmpty()
{
   return top == -1;
}
int isFull()
{
   return top == MAX - 1;
}
char peek()
{
   return stk[top];
}
char pop()
{
   if(isEmpty())
      return -1;
   char ch = stk[top];
   top--;
   return(ch);
}
void push(char oper)
{
   if(isFull())
      printf("Stack Full!!!!");
   else{
      top++;
      stk[top] = oper;
   }
}
 int checkIfOperand(char ch)
{
   return (ch >= 'a' && ch <= 'z') || (ch >= 'A' && ch <= 'Z');
}
 int precedence(char ch)
{
   switch (ch)
   {
   case '+':
   case '-':
      return 1;
   case '*':
   case '/':
      return 2;
   case '^':
```

```
      return 3;
   }
   return -1;
}
 int covertInfixToPostfix(char* expression)
{
   int i, j;
   for (i = 0, j = -1; expression[i]; ++i)
   {
       if (checkIfOperand(expression[i]))
          expression[++j] = expression[i];
       else if (expression[i] == '(')
          push(expression[i]);
       else if (expression[i] == ')')
      {
          while (!isEmpty() && peek() != '(')
             expression[++j] = pop();
          if (!isEmpty() && peek() != '(')
             return -1;
          else
             pop();
      }
      else
      {
          while (!isEmpty() && precedence(expression[i]) <= precedence(peek()))
             expression[++j] = pop();
          push(expression[i]);
      }
   }
   printf("postfix expression :: \t");
 while (!isEmpty())
      expression[++j] = pop();
   expression[++j] = '\0';
   printf( "%s\n", expression);
}
int main()
{
   char exp[100];
   char *e, x;
   printf("\nEnter the expression : ");
   scanf("%s",exp);
   e = exp;
   covertInfixToPostfix(exp);
   return 0;
}
```

Output:-



7. Write a program in C to implement the following data structures: Singly linked list, doubly linked list, singly linked circular list, doubly linked circular list. Perform insertion and deletion on these data structures.

7.1. Singly linked list

Program:-

```
#include<stdio.h>
#include<stdlib.h>
struct node
{
   int data;
   struct node *next;
};
struct node *head;

void beginsert ();
void lastinsert ();
void randominsert();
void begin_delete();
void last_delete();
void random_delete();
void display();
void search();
void main ()
{
   int choice =0;
   while(choice != 9)
   {
      printf("\nChoose one option from the following list ...\n");
       printf("\n1.Insert in begining\n2.Insert at last\n3.Insert at any random location\n4.Delete from
Beginning\n5.Delete from last\n6.Delete node after specified location\n7.Show\n8.Exit\n");
      printf("\nEnter your choice?\n");
      scanf("\n%d",&choice);
      switch(choice)
      {
         case 1:
         beginsert();
         break;
         case 2:
```

```
        lastinsert();
        break;
        case 3:
        randominsert();
        break;
        case 4:
        begin_delete();
        break;
        case 5:
        last_delete();
        break;
        case 6:
        random_delete();
        break;
        case 7:
        display();
        break;
        case 8:
        exit(0);
        break;
        default:
        printf("Please enter valid choice..");
      }
   }
}
void beginsert()
{
   struct node *ptr;
   int item;
   ptr = (struct node *) malloc(sizeof(struct node *));
   if(ptr == NULL)
   {
      printf("\nOVERFLOW");
   }
   else
   {
      printf("\nEnter value\n");
      scanf("%d",&item);
      ptr->data = item;
      ptr->next = head;
      head = ptr;
      printf("\nNode inserted");
   }

}
void lastinsert()
{
   struct node *ptr,*temp;
   int item;
   ptr = (struct node*)malloc(sizeof(struct node));
   if(ptr == NULL)
   {
      printf("\nOVERFLOW");
   }
```

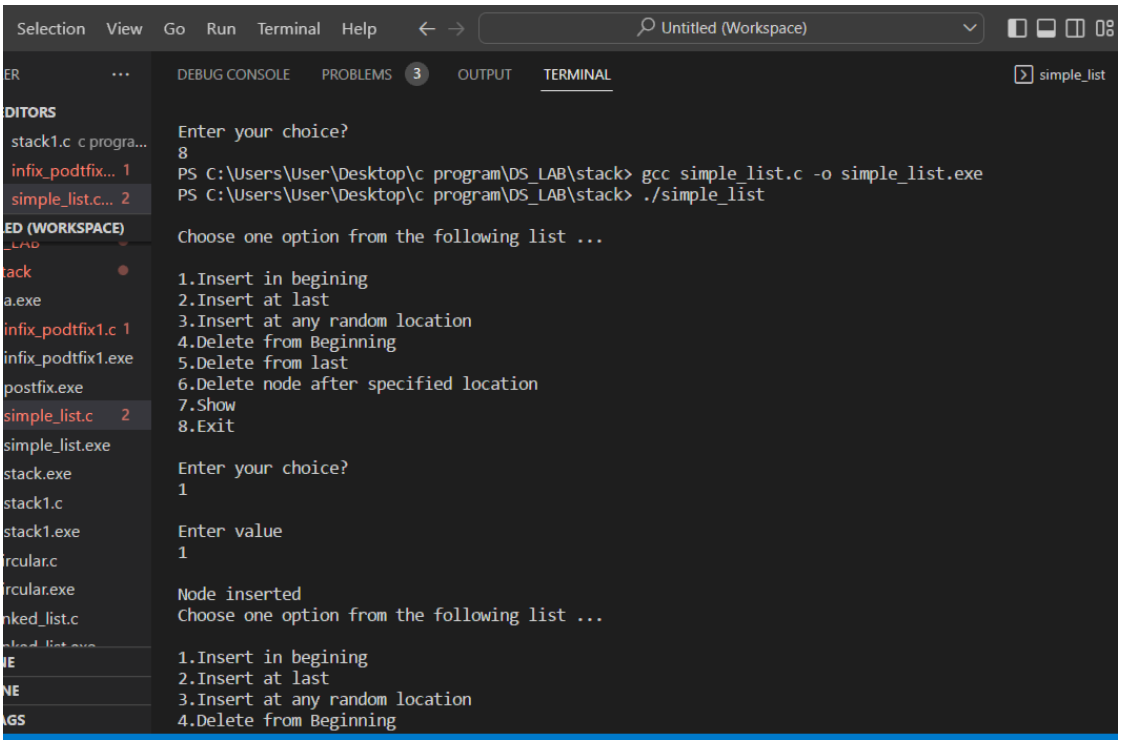
```
    else
    {
       printf("\nEnter value?\n");
       scanf("%d",&item);
       ptr->data = item;
       if(head == NULL)
       {
          ptr -> next = NULL;
          head = ptr;
          printf("\nNode inserted");
       }
       else
       {
          temp = head;
          while (temp -> next != NULL)
          {
             temp = temp -> next;
          }
          temp->next = ptr;
          ptr->next = NULL;
          printf("\nNode inserted");

       }
    }
}
void randominsert()
{
    int i,loc,item;
    struct node *ptr, *temp;
    ptr = (struct node *) malloc (sizeof(struct node));
    if(ptr == NULL)
    {
       printf("\nOVERFLOW");
    }
    else
    {
       printf("\nEnter element value");
       scanf("%d",&item);
       ptr->data = item;
       printf("\nEnter the location after which you want to insert ");
       scanf("\n%d",&loc);
       temp=head;
       for(i=0;i<loc;i++)
       {
          temp = temp->next;
          if(temp == NULL)
          {
             printf("\ncan't insert\n");
             return;
          }

       }
       ptr ->next = temp ->next;
       temp ->next = ptr;
```

```
      printf("\nNode inserted");
   }
}
void begin_delete()
{
   struct node *ptr;
   if(head == NULL)
   {
      printf("\nList is empty\n");
   }
   else
   {
      ptr = head;
      head = ptr->next;
      free(ptr);
      printf("\nNode deleted from the begining ...\n");
   }
}
void last_delete()
{
   struct node *ptr,*ptr1;
   if(head == NULL)
   {
      printf("\nlist is empty");
   }
   else if(head -> next == NULL)
   {
      head = NULL;
      free(head);
      printf("\nOnly node of the list deleted ...\n");
   }

   else
   {
      ptr = head;
      while(ptr->next != NULL)
      {
         ptr1 = ptr;
         ptr = ptr ->next;
      }
      ptr1->next = NULL;
      free(ptr);
      printf("\nDeleted Node from the last ...\n");
   }
}
void random_delete()
{
   struct node *ptr,*ptr1;
   int loc,i;
   printf("\n Enter the location of the node after which you want to perform deletion \n");
   scanf("%d",&loc);
   ptr=head;
   for(i=0;i<loc;i++)
   {
```

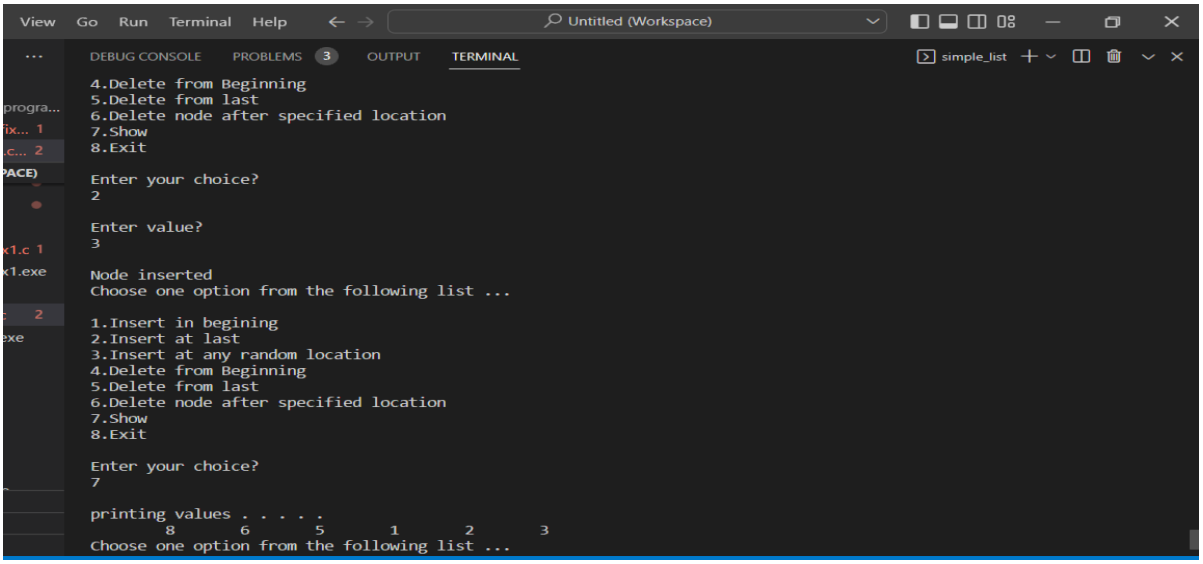
```
      ptr1 = ptr;
      ptr = ptr->next;

      if(ptr == NULL)
      {
         printf("\nCan't delete");
         return;
      }
   }
   ptr1 ->next = ptr ->next;
   free(ptr);
   printf("\nDeleted node %d ",loc+1);
}

void display()
{
   struct node *ptr;
   ptr = head;
   if(ptr == NULL)
   {
      printf("Nothing to print");
   }
   else
   {
      printf("\nprinting values . . . . .\n");
      while (ptr!=NULL)
      {
         printf("\t%d",ptr->data);
         ptr = ptr -> next;
      }
   }
}
```

Output:-

Insertion at beginning:-



Insertion at last:



Insertion at any location:-

```
DEBUG CONSOLE  PROBLEMS 3  OUTPUT  TERMINAL                    simple_list

Enter your choice?
3

Enter element value3

Enter the location after which you want to insert 1

Node inserted
Choose one option from the following list ...

1.Insert in begining
2.Insert at last
3.Insert at any random location
4.Delete from Beginning
5.Delete from last
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
7

printing values . . . . .
        1       2       3
Choose one option from the following list ...
```

Deletion:-

List before deletion:-

```
Enter your choice?
7

printing values . . . . .
       4       8       6       5       3       1       2       3
Choose one option from the following list ...
```

Deletion at beginning:

```
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
4

Node deleted from the begining ...

Choose one option from the following list ...

1.Insert in begining
2.Insert at last
3.Insert at any random location
4.Delete from Beginning
5.Delete from last
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
7

printing values . . . . .
       8       6       5       3       1       2       3
Choose one option from the following list ...

1.Insert in begining
2.Insert at last
```

Deletion at last

```
4.Delete from Beginning
5.Delete from last
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
5

Deleted Node from the last ...

Choose one option from the following list ...

1.Insert in begining
2.Insert at last
3.Insert at any random location
4.Delete from Beginning
5.Delete from last
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
7

printing values . . . . .
        8       6       5       3       1       2
Choose one option from the following list ...

1.Insert in begining
```

Deletion at given location:-

```
Go  Run  Terminal  Help   Untitled (Workspace)
DEBUG CONSOLE  PROBLEMS 3  OUTPUT  TERMINAL   simple_list
7.Show
8.Exit

Enter your choice?
6

 Enter the location of the node after which you want to perform deletion
3

Deleted node 4
Choose one option from the following list ...

1.Insert in begining
2.Insert at last
3.Insert at any random location
4.Delete from Beginning
5.Delete from last
6.Delete node after specified location
7.Show
8.Exit

Enter your choice?
7

printing values . . . . .
        8       6       5       1       2
Choose one option from the following list ...

1.Insert in begining
2.Insert at last
```

7.2. doubly linked list

Code:-

```
#include<stdio.h>
#include<stdlib.h>
struct node
{
struct node* prev;
int data;
struct node* next;
};
struct node* head = NULL;
void insert_at_beginning(int);
void insert_at_end(int);
void insert_at_position(int, int);
void delete_from_beginning();
void delete_from_position(int);
void delete_from_end();
```

```
void print_from_beginning();
void print_from_end(struct node*);
void search_data(int);
void update_node_data(int, int);
void list_sort();
struct node* create_node(int);
int size_of_list();
int getData();
int getPosition();
void empty_list_message();
void memory_error_message();
void invalid_position_message();
int main()
{
// char user_active = 'Y';
int user_choice;
int data, position;
while (1)
{
printf("----------------Nidhi singh 22MAI0015------------------");
printf("\n\n------ Doubly Linked List -------\n");
printf("\n1. Insert a node at the beginning");
printf("\n2. Insert a node at the end");
printf("\n3. Insert a node at the given position");
printf("\n\n4. Delete a node from the beginning");
printf("\n5. Delete a node from the end");
printf("\n6. Delete a node from the given position");
printf("\n\n7. Print list from the beginning");
printf("\n8. Search a node data");
printf("\n9. Exit");
printf("\n\n-----------------------------\n");
printf("\nEnter your choice: ");
scanf("%d", &user_choice);
printf("\n-----------------------------\n");
switch(user_choice)
{
case 1:
printf("\nInserting a node at beginning");
data = getData();
insert_at_beginning(data);
break;
case 2:
printf("\nInserting a node at end");
data = getData();
insert_at_end(data);
break;
case 3:
printf("\nInserting a node at the given position");
data = getData();
position = getPosition();
insert_at_position(data, position);
break;
case 4:
printf("\nDeleting a node from beginning\n");
```

```
delete_from_beginning();
break;
case 5:
printf("\nDeleting a node from end\n");
delete_from_end();
break;
case 6:
printf("\nDelete a node from given position\n");
position = getPosition();
delete_from_position(position);
break;
case 7:
printf("\nPrinting the list from beginning\n\n");
print_from_beginning();
break;
case 8:
printf("\nSearching the node data");
data = getData();
search_data(data);
break;
case 9:
printf("\nProgram was terminated\n\n");
return 0;
default:
printf("\n\tInvalid Choice\n");
}
printf("\n.....\n");
// printf("\nDo you want to continue? (Y/N) : ");
// fflush(stdin);
// scanf(" %c", &user_active);
}
return 0;
}
void memory_error_message()
{
printf("\nMemory was not allocated!\n");
}
void invalid_position_message()
{
printf("\nInvalid position!\n");
}
void empty_list_message()
{
printf("\nList is Empty!\n");
}
struct node* create_node(int data)
{
struct node* new_node = (struct node*) malloc(sizeof(struct
node));
if (new_node == NULL)
{
return NULL;
}
else
```

```
{
new_node->prev = NULL;
new_node->data = data;
new_node->next = NULL;
}
}
void insert_at_beginning(int data)
{
struct node* new_node = create_node(data);
if (new_node == NULL)
{
memory_error_message();
return;
}
else if(head == NULL)
{
head = new_node;
}
else
{
new_node->next = head;
head->prev = new_node;
head = new_node;
}
printf("\n* Node with data %d was inserted \n", data);
}
void insert_at_end(int data)
{
struct node* new_node = create_node(data);
if (new_node == NULL)
{
memory_error_message();
return;
}
else if (head == NULL)
{
head = new_node;
}
else
{
struct node* temp = head;
while (temp->next != NULL)
{
temp = temp = temp->next;
}
temp->next = new_node;
new_node->prev = temp;
}
printf("\n* Node with data %d was inserted \n", data);
}
void insert_at_position(int data, int pos)
{
struct node* new_node = create_node(data);
int size = size_of_list();
```

```
if (new_node == NULL)
{
memory_error_message();
return;
}
else if (head != NULL && (pos < 1 || pos > size))
{
invalid_position_message();
return;
}
else if (head == NULL && pos == 1)
{
head = new_node;
}
else if (head != NULL && pos == 1)
{
new_node->next = head;
head->prev = new_node;
head = new_node;
}
else
{
struct node* temp = head;
int count = 1;
while (++count < pos)
{
temp = temp->next;
}
temp->next->prev = new_node;
new_node->next = temp->next;
temp->next = new_node;
new_node->prev = temp;
}
printf("\n* Node with data %d was inserted \n", data);
}
void delete_from_beginning()
{
if (head == NULL)
{
empty_list_message();
return;
}
struct node* temp = head;
head = head->next;
int data = temp->data;
free(temp);
printf("\n* Node with data %d was deleted \n", data);
}
void delete_from_end()
{
if (head == NULL)
{
empty_list_message();
return;
```

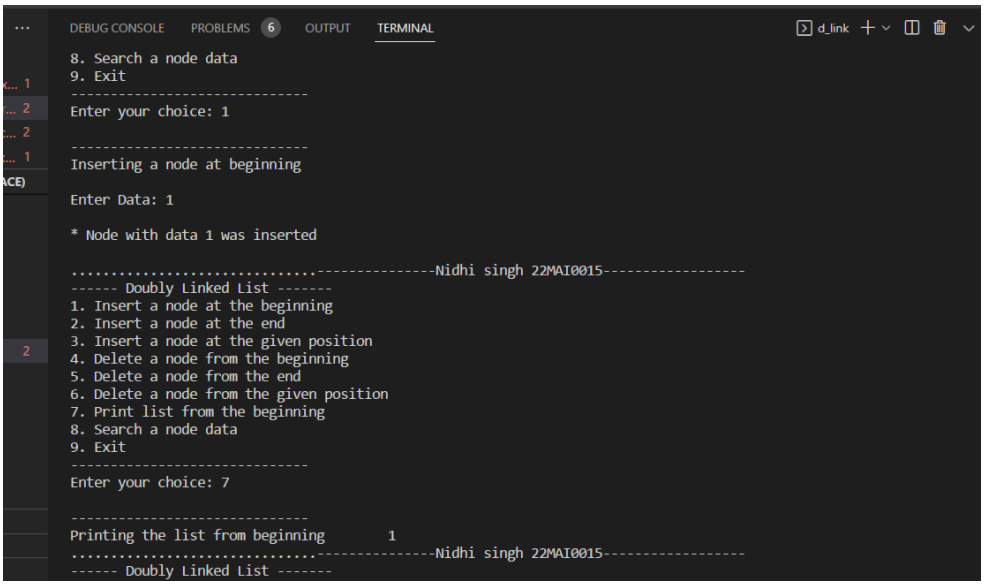
```
}
struct node* temp = head;
int data = 0;
while (temp->next != NULL)
{
temp = temp->next;
}
if (temp->prev == NULL)
{
head = NULL;
}
else
{
temp->prev->next = temp->next;
}
data = temp->data;
free(temp);
printf("\n* Node with data %d was deleted \n", data);
}
void delete_from_position(int pos)
{
if (head == NULL)
{
empty_list_message();
return;
}
int size = size_of_list();
struct node* temp = head;
int data = 0;
if (pos < 1 || pos > size)
{
invalid_position_message();
return;
}
else if (pos == 1)
{
head = head->next;
data = head->data;
free(temp);
printf("\n* Node with data %d was deleted \n", data);
}
else
{
int count = 0;
while (++count < pos)
{
temp = temp->next;
}
temp->prev->next = temp->next;
if (pos != size)
{
temp->next->prev = temp->prev;
}
data = temp->data;
```

```
free(temp);
printf("\n* Node with data %d was deleted \n", data);
}
}
void print_from_beginning()
{
struct node* temp = head;
while (temp != NULL)
{
printf("%d ", temp->data);
temp = temp->next;
}
}
void search_data(int data)
{
struct node* temp = head;
int position = 0;
int flag = 0;
while (temp != NULL)
{
position += 1;
if (temp->data == data)
{
flag = 1;
break;
}
temp = temp->next;
}
if (flag == 0)
{
printf("\nNode with data %d was not found\n", data);
}
else
{
printf("\nNode found at %d position\n", position);
}
}
int getData()
{
int data;
printf("\n\nEnter Data: ");
scanf("%d", &data);
return data;
}
int getPosition()
{
int position;
printf("\nEnter Position: ");
scanf("%d", &position);
return position;
}
int size_of_list()
{
struct node* temp = head;
```

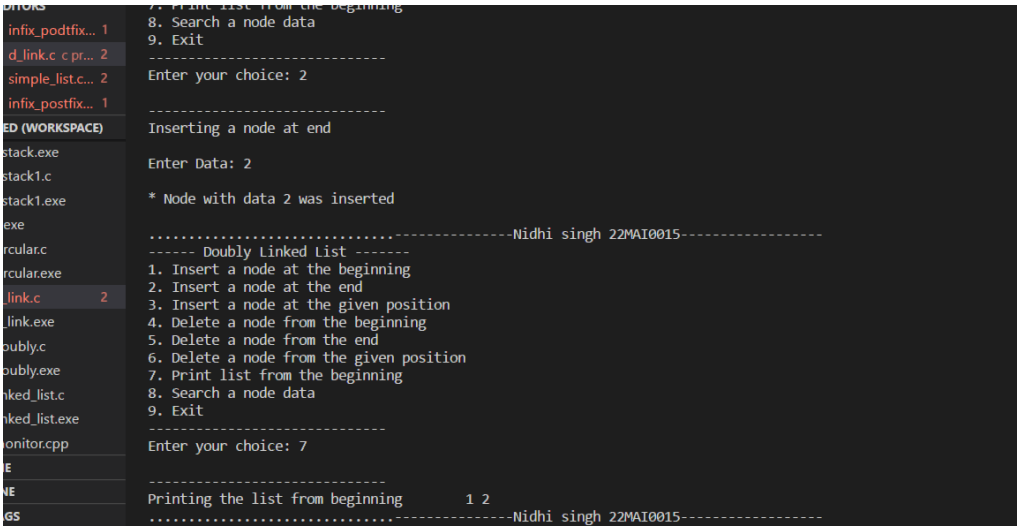
```
int count = 0;
while (temp != NULL)
{
count += 1;
temp = temp->next;
}
return count;
}
```

Output:-

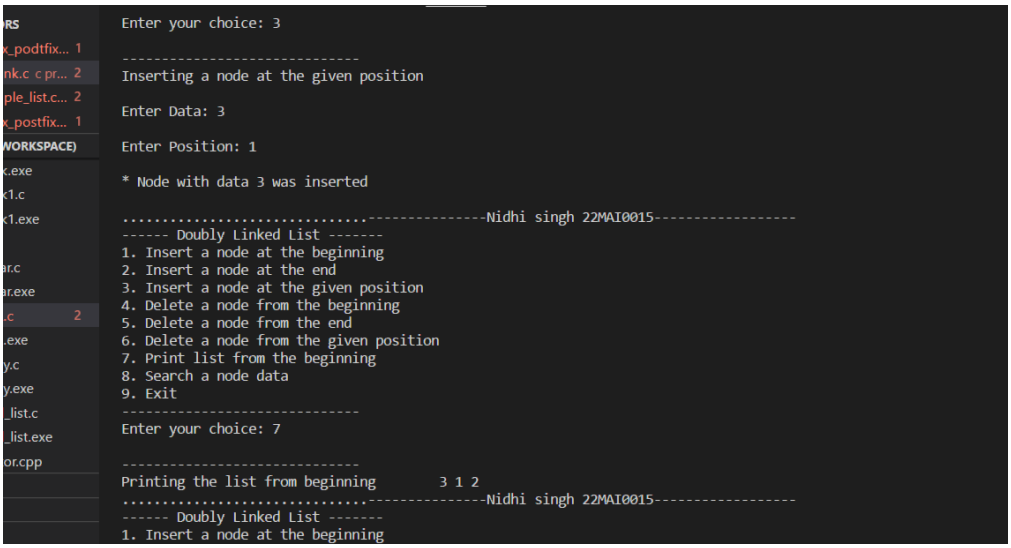
Insertion at beginning:-



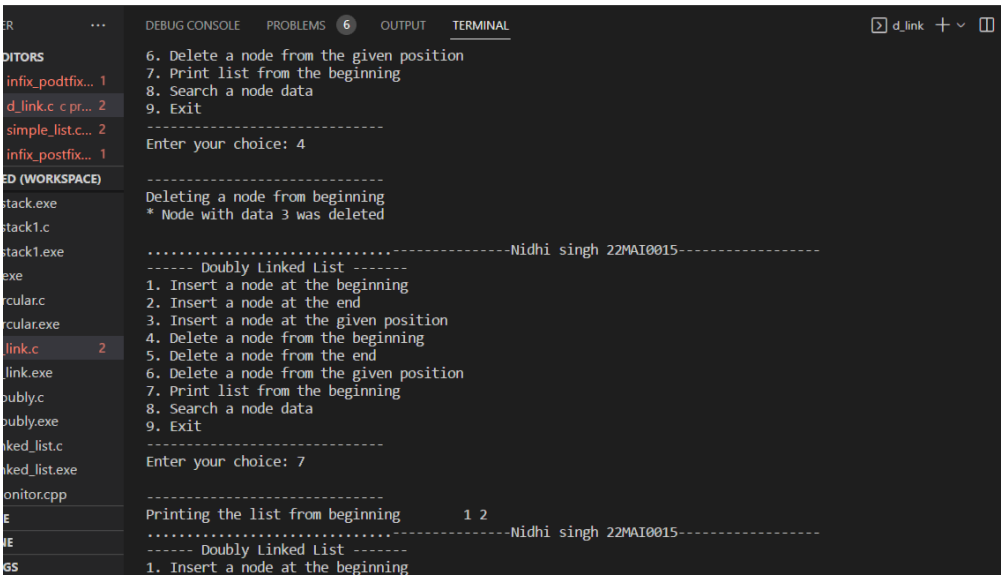
Insertion at last:-



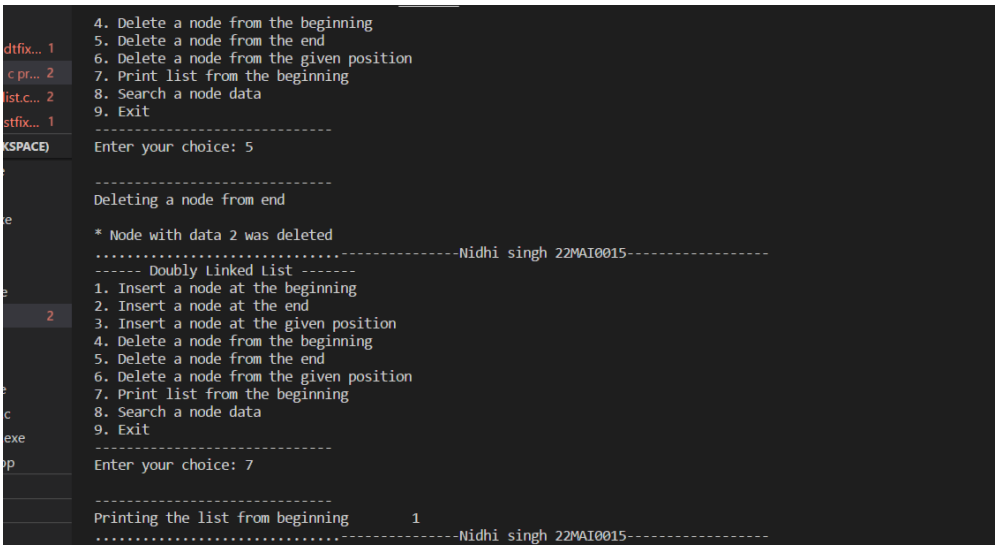
Insertion at given location:-



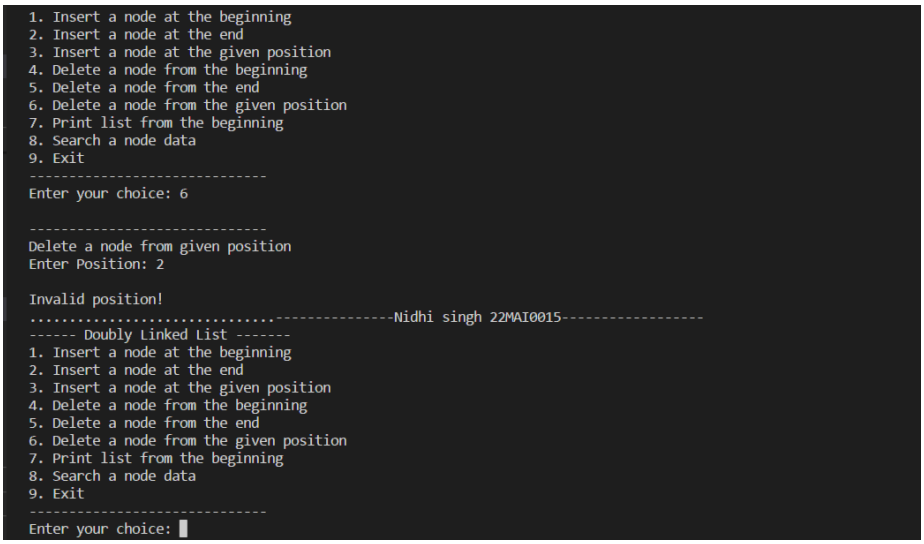
Deletion at beginning



Deletion at last



Deletion at given location



7.3. singly linked circular list

```
#include<stdio.h>
#include<stdlib.h>
struct node
{
int data;
struct node *next;
};
struct node *head;
void beginsert ();
void lastinsert ();
void randominsert();
void begin_delete();
void last_delete();
void random_delete();
void display();
void search();
void main ()
{
int choice =0;
while(choice != 7)
{
printf("\n*********Main Menu*********\n");
printf("\nChoose one option from the following list ...\n");
printf("\n===============================================\n");
printf("\n1.Insert in begining\n2.Insert at last\n3.Delete from Beginning\n");
printf("4.Delete from last\n5.Search for an element\n6.Show\n7.Exit\n");
printf("\nEnter your choice?\n");
scanf("\n%d",&choice);
switch(choice)
{
case 1:
beginsert();
break;
case 2:
```

```
lastinsert();
break;
case 3:
begin_delete();
break;
case 4:
last_delete();
break;
case 5:
search();
break;
case 6:
display();
break;
case 7:
exit(0);
break;
default:
printf("Please enter valid choice..");
}
}
}
void beginsert()
{
struct node *ptr,*temp;
int item;
ptr = (struct node *)malloc(sizeof(struct node));
if(ptr == NULL)
{
printf("\nOVERFLOW");
}
else
{
printf("\nEnter the node data?");
scanf("%d",&item);
ptr -> data = item;
if(head == NULL)
{
head = ptr;
ptr -> next = head;
}
else
{
temp = head;
while(temp->next != head)
temp = temp->next;
ptr->next = head;
temp -> next = ptr;
head = ptr;
}
printf("\nnode inserted\n");
}
}
void lastinsert()
```

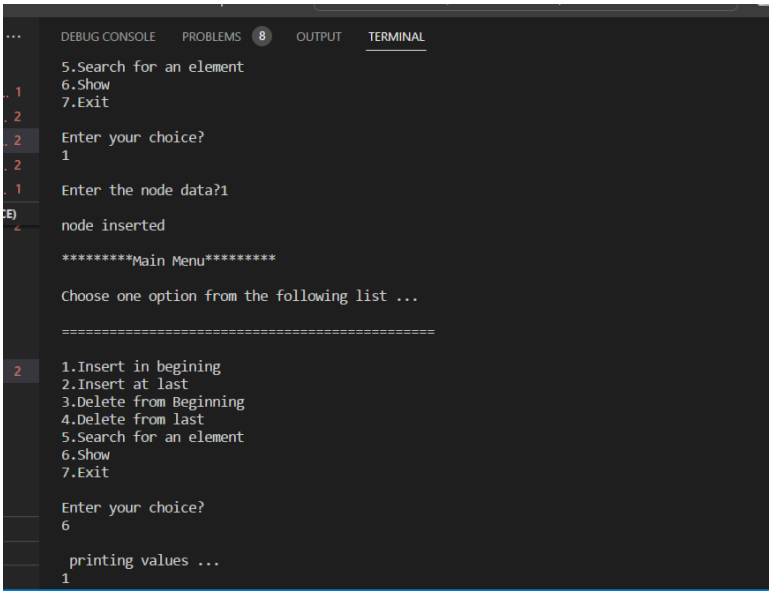
```
{
struct node *ptr,*temp;
int item;
ptr = (struct node *)malloc(sizeof(struct node));
if(ptr == NULL)
{
printf("\nOVERFLOW\n");
}
else
{
printf("\nEnter Data?");
scanf("%d",&item);
ptr->data = item;
if(head == NULL)
{
head = ptr;
ptr -> next = head;
}
else
{
temp = head;
while(temp -> next != head)
{
temp = temp -> next;
}
temp -> next = ptr;
ptr -> next = head;
}
printf("\nnode inserted\n");
}
}
void begin_delete()
{
struct node *ptr;
if(head == NULL)
{
printf("\nUNDERFLOW");
}
else if(head->next == head)
{
head = NULL;
free(head);
printf("\nnode deleted\n");
}
else
{ ptr = head;
while(ptr -> next != head)
ptr = ptr -> next;
ptr->next = head->next;
free(head);
head = ptr->next;
printf("\nnode deleted\n");
}
}
```

```
void last_delete()
{
struct node *ptr, *preptr;
if(head==NULL)
{
printf("\nUNDERFLOW");
}
else if (head ->next == head)
{
head = NULL;
free(head);
printf("\nnode deleted\n");
}
else
{
ptr = head;
while(ptr ->next != head)
{
preptr=ptr;
ptr = ptr->next;
}
preptr->next = ptr -> next;
free(ptr);
printf("\nnode deleted\n");
}
}
void search()
{
struct node *ptr;
int item,i=0,flag=1;
ptr = head;
if(ptr == NULL)
{
printf("\nEmpty List\n");
}
else
{
printf("\nEnter item which you want to search?\n");
scanf("%d",&item);
if(head ->data == item)
{
printf("item found at location %d",i+1);
flag=0;
}
else
{
while (ptr->next != head)
{
if(ptr->data == item)
{
printf("item found at location %d ",i+1);
flag=0;
break;
}
```

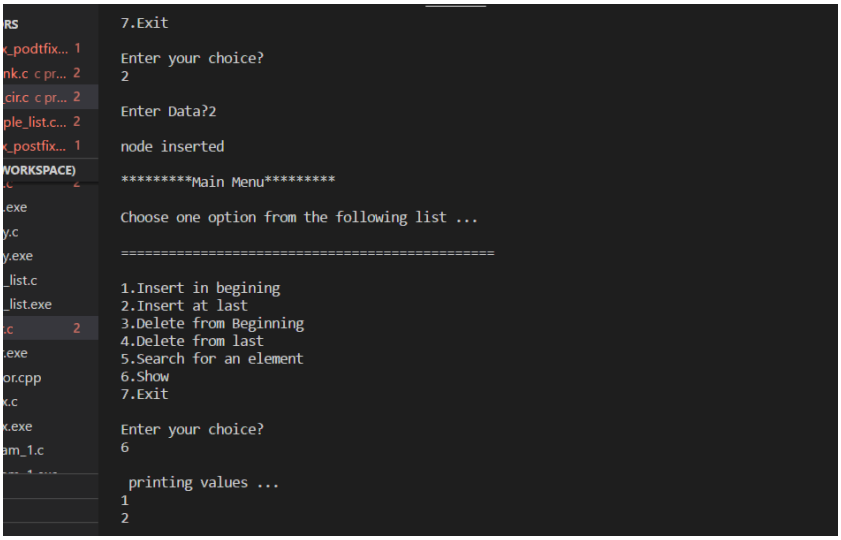
```
else
{
flag=1;
}
i++;
ptr = ptr -> next;
}
}
if(flag != 0)
{
printf("Item not found\n");
}
}
}
void display()
{
struct node *ptr;
ptr=head;
if(head == NULL)
{
printf("\nnothing to print");
}
else
{
printf("\n printing values ... \n");
while(ptr -> next != head)
{
printf("%d\n", ptr -> data);
ptr = ptr -> next;
}
printf("%d\n", ptr -> data);
}
}
```

Output:-

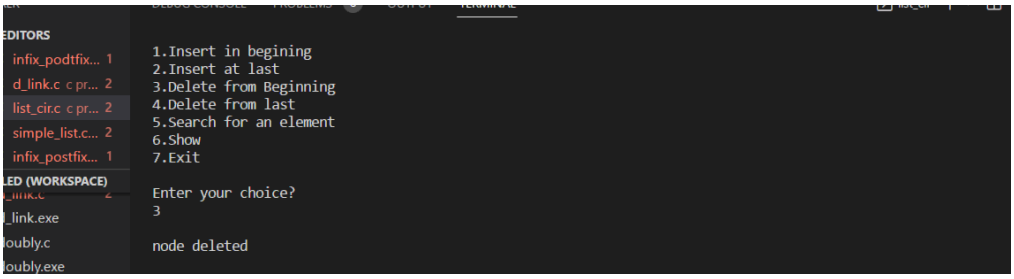
Insertion at beginning:-



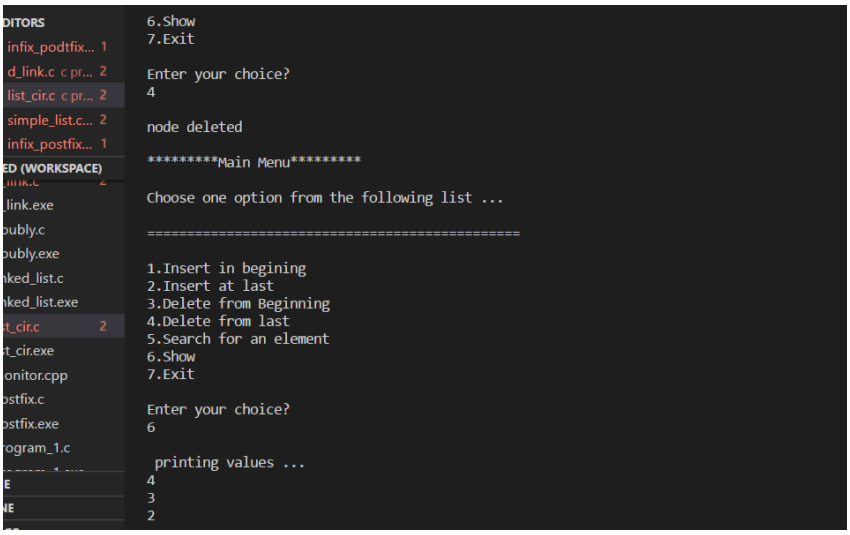
Insertion at last:-



Deletion at beginning



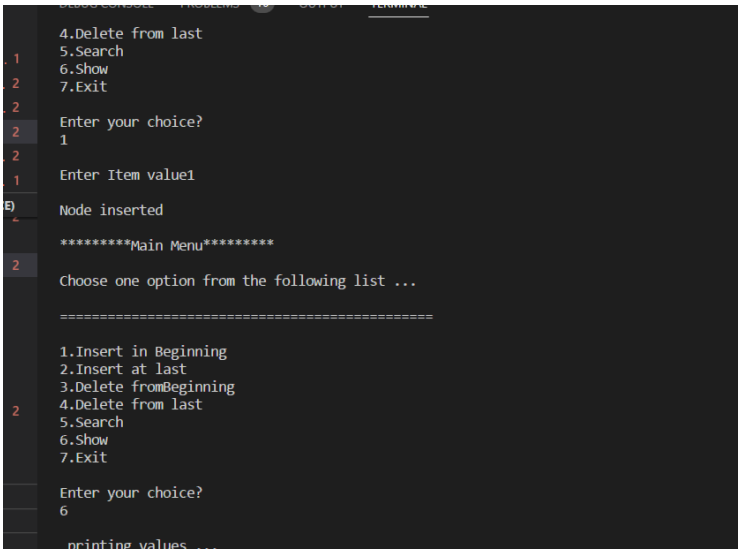
Deletion at last



Search

7.4.doubly linked circular list

Insertion at beginning:-



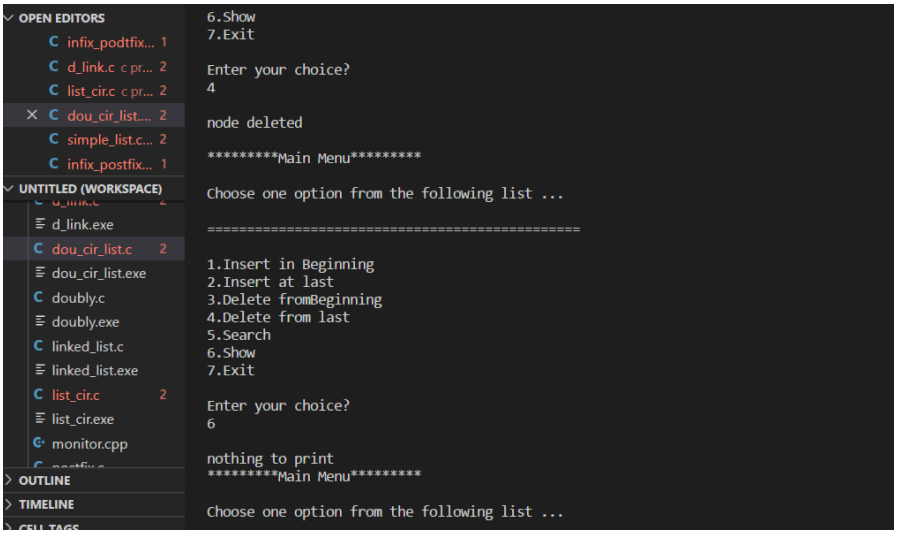
Insertion at last:-

```
Enter your choice?
2

Enter value3

node inserted

*********Main Menu*********

Choose one option from the following list ...

==============================================

1.Insert in Beginning
2.Insert at last
3.Delete fromBeginning
4.Delete from last
5.Search
6.Show
7.Exit

Enter your choice?
6

 printing values ...
1
3
```

Deletion at beginning

```
2.Insert at last
3.Delete fromBeginning
4.Delete from last
5.Search
6.Show
7.Exit

Enter your choice?
3

*********Main Menu*********

Choose one option from the following list ...

==============================================

1.Insert in Beginning
2.Insert at last
3.Delete fromBeginning
4.Delete from last
5.Search
6.Show
7.Exit

Enter your choice?
6

 printing values ...
3
```

Deletion at last

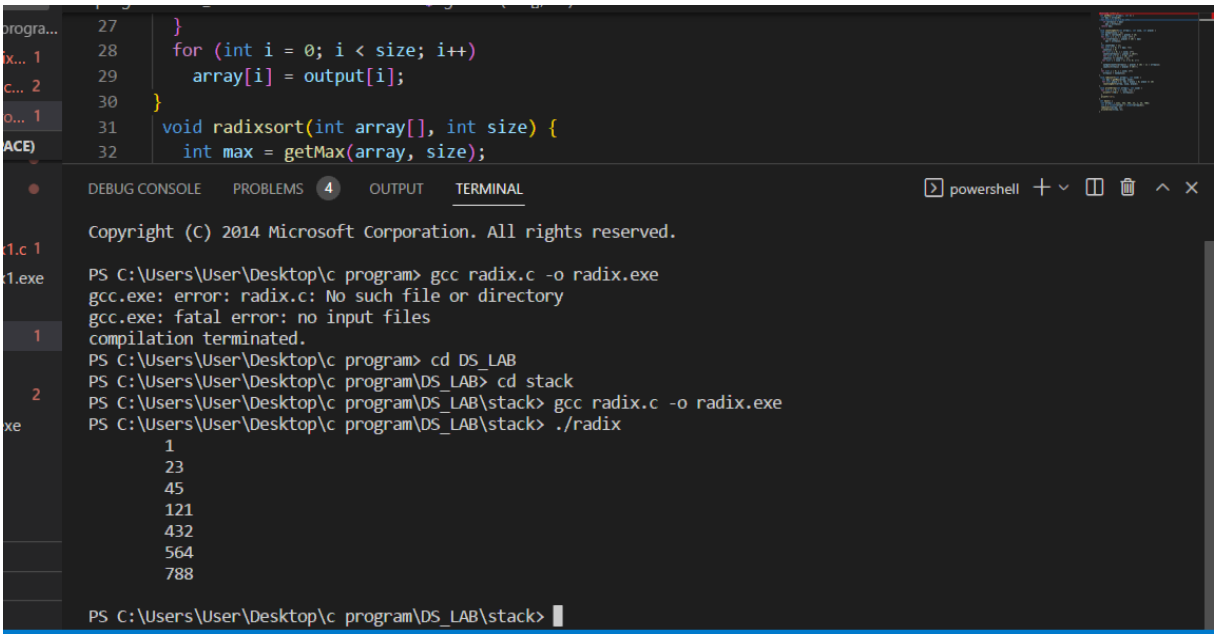


8. Write a program in C to perform radix sort

Program:-

```
#include <stdio.h>
int getMax(int array[], int n) {
 int max = array[0];
 for (int i = 1; i < n; i++)
  if (array[i] > max)
   max = array[i];
 return max;
}
void countingSort(int array[], int size, int place) {
 int output[size + 1];
 int max = (array[0] / place) % 10;
 for (int i = 1; i < size; i++) {
  if (((array[i] / place) % 10) > max)
   max = array[i];
 }
 int count[max + 1];
 for (int i = 0; i < max; ++i)
  count[i] = 0;
 for (int i = 0; i < size; i++)
  count[(array[i] / place) % 10]++;
 for (int i = 1; i < 10; i++)
  count[i] += count[i - 1];
 for (int i = size - 1; i >= 0; i--)
 {
  output[count[(array[i] / place) % 10] - 1] = array[i];
  count[(array[i] / place) % 10]--;
 }
 for (int i = 0; i < size; i++)
  array[i] = output[i];
}
void radixsort(int array[], int size) {
 int max = getMax(array, size);
 for (int place = 1; max / place > 0; place *= 10)
  countingSort(array, size, place);
}
void printArray(int array[], int size) {
 for (int i = 0; i < size; ++i) {
  printf("\t%d\n  ", array[i]);
 }
 printf("\n");
}
int main() {
 int array[] = {121, 432, 564, 23, 1, 45, 788};
 int n = sizeof(array) / sizeof(array[0]);
 radixsort(array, n);
 printArray(array, n);
}
```

Output:-



9. Write a program in C to perform insertion sort

```
#include <stdio.h>
void printArray(int array[], int size) {
 for (int i = 0; i < size; i++) {
  printf("\n\t%d ", array[i]);
 }
 printf("\n");
}
void insertionSort(int array[], int size) {
 for (int step = 1; step < size; step++) {
  int key = array[step];
  int j = step - 1;
while (key < array[j] && j >= 0) {
   array[j + 1] = array[j];
   --j;
  }
  array[j + 1] = key;
 }
}
int main() {
 int data[] = {9, 5, 1, 4, 3,6,45,13,98,8,4,2};
 int size = sizeof(data) / sizeof(data[0]);
 for (int i = 0; i < size; i++) {
  printf("\n\t%d ", data[i]);
 }
 insertionSort(data, size);
 printf("Sorted array in ascending order:\n");
 printArray(data, size);
}
```

Output:-

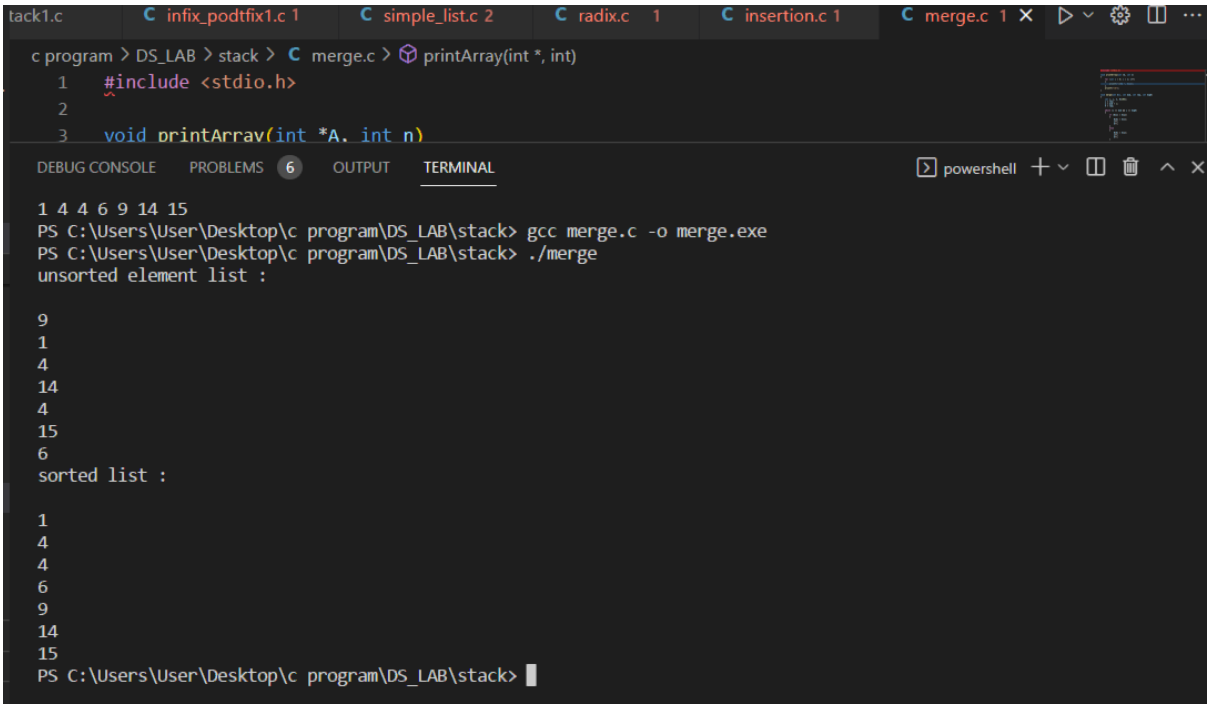
```
PS C:\Users\User\Desktop\c program\DS_LAB\stack> gcc insertion.c -o insertion.exe
PS C:\Users\User\Desktop\c program\DS_LAB\stack> ./insertion

        9
        5
        1
        4
        3
        6
        45
        13
        98
        8
        4
        2 Sorted array in ascending order:

        1
        2
        3
        4
        4
        5
        6
        8
        9
        13
        45
        98
PS C:\Users\User\Desktop\c program\DS_LAB\stack>
```

10. Write a program in C to perform merge sort

Program:-

```
#include <stdio.h>
void printArray(int *A, int n)
{
   for (int i = 0; i < n; i++)
   {
      printf("\n%d ", A[i]);
   }
   printf("\n");
}

void merge(int A[], int mid, int low, int high)
{
   int i, j, k, B[100];
   i = low;
   j = mid + 1;
   k = low;

   while (i <= mid && j <= high)
   {
      if (A[i] < A[j])
      {
         B[k] = A[i];
         i++;
         k++;
      }
      else
      {
         B[k] = A[j];
```

```
            j++;
            k++;
        }
    }
    while (i <= mid)
    {
        B[k] = A[i];
        k++;
        i++;
    }
    while (j <= high)
    {
        B[k] = A[j];
        k++;
        j++;
    }
    for (int i = low; i <= high; i++)
    {
        A[i] = B[i];
    }

}

void mergeSort(int A[], int low, int high){
    int mid;
    if(low<high){
        mid = (low + high) /2;
        mergeSort(A, low, mid);
        mergeSort(A, mid+1, high);
        merge(A, mid, low, high);
    }
}

int main()
{
    // int A[] = {9, 14, 4, 8, 7, 5, 6};
    int A[] = {9, 1, 4, 14, 4, 15, 6};
    int n = sizeof(A) / sizeof(A[0]);
   printf("unsorted element list : \n");
    printArray(A, n);
    mergeSort(A, 0, n-1);
    printf("sorted list : \n");
    printArray(A, n);
    return 0;
}
```



11. Write a program in C to perform selection sort

Program:-

```
#include <stdio.h>
void swap(int *xp, int *yp)
{
   int temp = *xp;
   *xp = *yp;
   *yp = temp;
}
void selectionSort(int arr[], int n)
{
   int i, j, min_idx;
 for (i = 0; i < n-1; i++)
   {
      min_idx = i;
      for (j = i+1; j < n; j++)
      if (arr[j] < arr[min_idx])
         min_idx = j;
      if(min_idx != i)
         swap(&arr[min_idx], &arr[i]);
   }
}
 void printArray(int arr[], int size)
{
   int i;
   for (i=0; i < size; i++)
      printf("%d ", arr[i]);
   printf("\n");
}
 int main()
{
   int arr[] = {64,25,1,4,2,8,2,6,4,12,22,11};
```

```
    int n = sizeof(arr)/sizeof(arr[0]);
    selectionSort(arr, n);
    printf("Sorted array: \n");
    printArray(arr, n);
    return 0;
}
```

Output:-