WEEK 7

Lab Exercises:

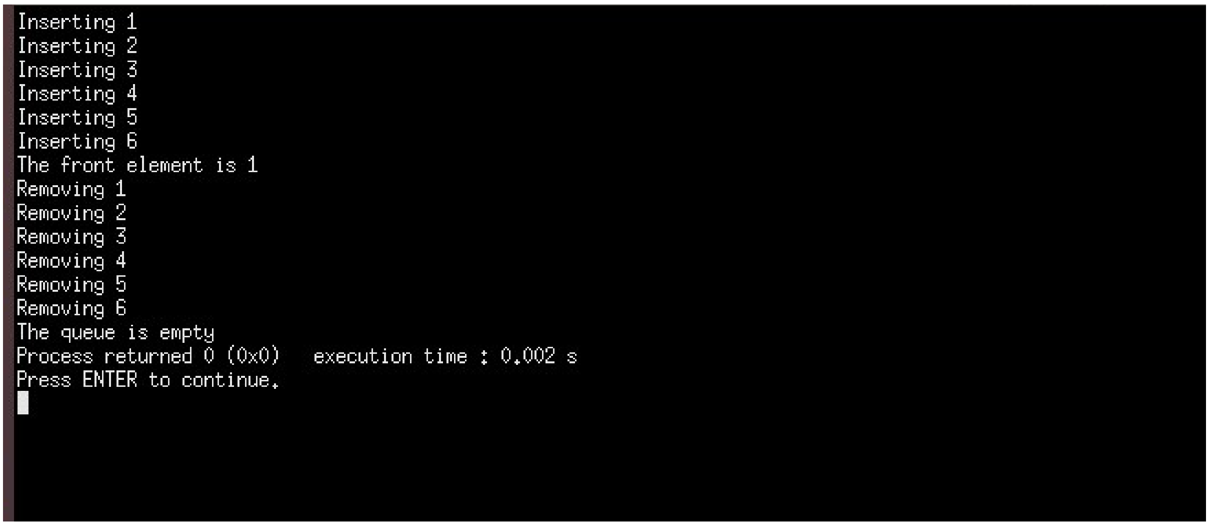
1. Implement a queue using singly linked list without header node.

Code:

```
#include <stdio.h>
#include <stdlib.h>
// A Linked List Node
struct Node
{
int data;
// integer data
struct Node *next;
// pointer to the next node
} *rear = NULL, *front = NULL;
// Utility function to allocate the new queue node
struct Node * newNode (int item)
{
// allocate a new node in a heap
struct Node *node = (struct Node *) malloc (sizeof (struct Node));
// check if the queue (heap) is full. Then inserting an element would
// lead to heap overflow
if (node != NULL)
{
// set data in the allocated node and return it
node->data = item;
node->next = NULL;
return node;
}
else
{
printf ("\nHeap Overflow");
exit (EXIT_FAILURE);
}
}
// Utility function to dequeue the front element
int dequeue ()
// delete at the beginning
{
if (front == NULL)
{
printf ("\nQueue Underflow");
exit (EXIT_FAILURE);
}
struct Node *temp = front;
printf ("Removing %d\n", temp->data);
// advance front to the next node
front = front->next;
// if the list becomes emptyif (front == NULL)
{
rear = NULL;
}
// deallocate the memory of the removed node and
// optionally return the removed item
int item = temp->data;
free (temp);
return item;
}
// Utility function to add an item to the queue
void enqueue (int item)
// insertion at the end
{
// allocate a new node in a heap
struct Node *node = newNode (item);
printf ("Inserting %d\n", item);
// special case: queue was empty
if (front == NULL)
{
// initialize both front and rear
front = node;
rear = node;
}
else
{
// update rear
rear->next = node;
rear = node;
}
}
// Utility function to return the top element in a queue
int peek ()
{
// check for an empty queue
if (front != NULL)
{
return front->data;
}
else
{
exit (EXIT_FAILURE);
}
}
// Utility function to check if the queue is empty or not
```

```
int isEmpty ()
{
return rear == NULL && front == NULL;}
int main ()
{
enqueue (1);
enqueue (2);
enqueue (3);
enqueue (4);
enqueue (5);
enqueue (6);
printf ("The front element is %d\n", peek ());
dequeue ();
dequeue ();
dequeue ();
dequeue ();
dequeue ();
dequeue ();
if (isEmpty ())
{
printf ("The queue is empty");
}
else
{
printf ("The queue is not empty");
}
return 0;
}
```

Test Case:



```
Inserting 1
Inserting 2
Inserting 3
Inserting 4
Inserting 5
Inserting 6
The front element is 1
Removing 1
Removing 2
Removing 3
Removing 4
Removing 5
Removing 6
The queue is empty
Process returned 0 (0x0)   execution time : 0.002 s
Press ENTER to continue.
```

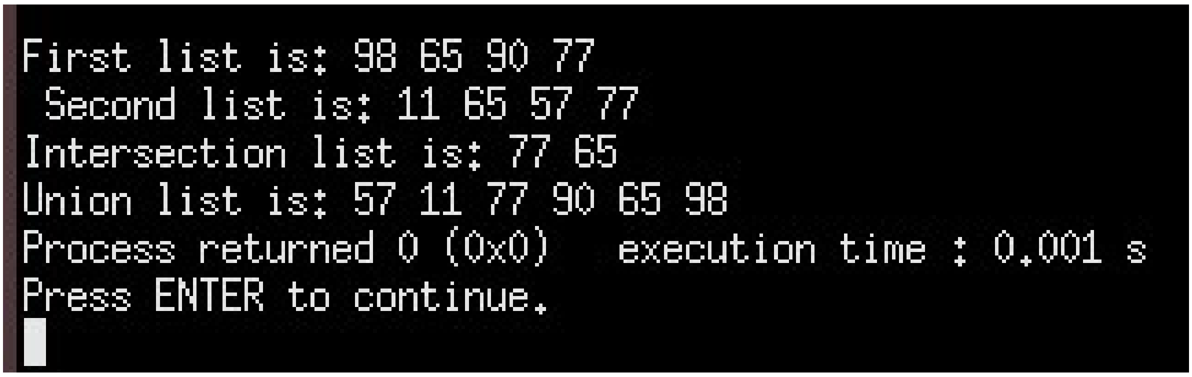
2. Perform UNION and INTERSECTION set operations on singly linked lists with header node.

Code:

```
#include <stdbool.h>
#include <stdio.h>
#include <stdlib.h>
struct Node
{
int data;
struct Node *next;
};void push (struct Node **head_ref, int new_data);
bool isPresent (struct Node *head, int data);
struct Node * getUnion (struct Node *head1, struct Node *head2)
{
struct Node *result = NULL;
struct Node *t1 = head1, *t2 = head2;
while (t1 != NULL)
{
push (&result, t1->data);
t1 = t1->next;
}
while (t2 != NULL)
{
if (!isPresent (result, t2->data))
push (&result, t2->data);
t2 = t2->next;
}
return result;
}
struct Node * getIntersection (struct Node *head1, struct Node *head2)
{
struct Node *result = NULL;
struct Node *t1 = head1;
while (t1 != NULL)
{
if (isPresent (head2, t1->data))
push (&result, t1->data);
t1 = t1->next;
}
return result;
}
void push (struct Node **head_ref, int new_data)
{
struct Node *new_node = (struct Node *) malloc (sizeof (struct Node));
new_node->data = new_data;
new_node->next = (*head_ref);
(*head_ref) = new_node;
}
void printList (struct Node *node)
```

```
{
while (node != NULL)
{
printf ("%d ", node->data);
node = node->next;
}
}
bool isPresent (struct Node *head, int data)
{
struct Node *t = head;
while (t != NULL)
{
if (t->data == data)return 1;
t = t->next;
}
return 0;
}
int main ()
{
struct Node *head1 = NULL;
struct Node *head2 = NULL;
struct Node *intersecn = NULL;
struct Node *unin = NULL;
push (&head1, 77);
push (&head1, 90);
push (&head1, 65);
push (&head1, 98);
push (&head2, 77);
push (&head2, 57);
push (&head2, 65);
push (&head2, 11);
intersecn = getIntersection (head1, head2);
unin = getUnion (head1, head2);
printf ("\nFirst list is: ");
printList (head1);
printf ("\n Second list is: ");
printList (head2);
printf ("\nIntersection list is: ");
printList (intersecn);
printf ("\nUnion list is: ");
printList (unin);
return 0;
}
```

Test Case:



```
First list is: 98 65 90 77
 Second list is: 11 65 57 77
Intersection list is: 77 65
Union list is: 57 11 77 90 65 98
Process returned 0 (0x0)   execution time : 0.001 s
Press ENTER to continue.
```