# Homework: Data Structures, Algorithms and Complexity

This document defines the **homework assignments** for the ["Data Structures" course @ Software University](https://softuni.bg/trainings/1147/Data-Structures-June-2015). Please submit a single zip / rar / 7z archive holding the solutions (source code) of all below described problems.

## Class StupidList<T>

You are given the C# class StupidList<T> which implements a list of generic type T with operations Add(T), Remove(index), RemoveFirst(), RemoveLast(), this[index] (access by index), Length, First and Last:

|  |
| --- |
| public class StupidList<T>  {  private T[] arr = new T[0];  public int Length  {  get  {  return this.arr.Length;  }  }  public T this[int index]  {  get  {  return this.arr[index];  }  }  public T First  {  get  {  return this.arr[0];  }  }  public T Last  {  get  {  return this.arr[this.arr.Length - 1];  }  }  public void Add(T item)  {  var newArr = new T[this.arr.Length + 1];  Array.Copy(this.arr, newArr, this.arr.Length);  newArr[newArr.Length - 1] = item;  this.arr = newArr;  }  public T Remove(int index)  {  T result = this.arr[index];  var newArr = new T[this.arr.Length - 1];  Array.Copy(this.arr, newArr, index);  Array.Copy(this.arr, index + 1, newArr, index, this.arr.Length - index - 1);  this.arr = newArr;  return result;  }  public T RemoveFirst()  {  return this.Remove(0);  }  public T RemoveLast()  {  return this.Remove(this.Length - 1);  }  } |

Submit the results of all complexity calculations in a single text file.

## Add(T) Complexity

Calculate the expected running time O(f(n)) of the Add(T) operation in the above code in the **worst case**.

Answer: O(n)

## Remove(index) Complexity – Worst Case

Calculate the expected running time O(f(n)) of the Remove(index) operation in the **worst case**.

Answer: O(n)

## Remove(index) Complexity – Best Case

Calculate the expected running time O(f(n)) of the Remove(index) operation in the **best case**.

Answer: O(1) – empty or single item array

## Remove(index) Complexity – Average Case

Calculate the expected running time O(f(n)) of the Remove(index) operation in the **average case**.

Answer: O(n)

## RemoveFirst(T) Complexity

Calculate the expected running time O(f(n)) of the RemoveFirst(T) operation. Submit the result in a text file.

Answer: O(n)

## RemoveLast(T) Complexity

Calculate the expected running time O(f(n)) of the RemoveLast(T) operation. Submit the result in a text file.

Answer: O(n)

## Length Complexity

Calculate the expected running time O(f(n)) of the Length operation. Submit the result in a text file.

Answer: O(1)

## This[index] Complexity

Calculate the expected running time O(f(n)) of the operation this[index]. Submit the result in a text file.

Answer: O(1)

## First Complexity

Calculate the expected running time O(f(n)) of the First operation. Submit the result in a text file.

Answer: O(1)

## Last Complexity

Calculate the expected running time O(f(n)) of the Last operation. Submit the result in a text file.

Answer: O(1)