CME 112- Programming Languages II

Week 7
String Functions
Sorting & Searching

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Science is trying to understand the language of nature. Those who understand the language are friendly to nature, and those who do not understand are enemies

String

A string is an array of characters terminated by the NULL char ‘\0’

Example: char str[8];

- Declares a char array that contains at most 8 chars
- If char array str will be used to store strings, it can contain at most 7 chars and MUST be terminated by the NULL char ‘\0’

String İşlemleri

- C standard library provides many functions to manipulate strings.
- You need to include <string.h> to use these functions

```
#include <string.h>
```

- Here are some of the important functions:
  - **strcpy(char *str1, const char *str2);**
  - **strlen(const char *str);**
  - **strcat(char *str1, const char *str2);**
  - **strcmp(const char *str1, const char *str2);**

Strcpy Fonksiyonu


```
char *strcpy(char *str1, const char *str2)
{
  char *p = str1;

  while (*str2)
      *p++ = *str2++;

  *p = '\0';
  return str1;
} /* end-strcpy */
```

Strcpy Fonksiyonu


```
#include <stdio.h>
#include <string.h>
int main () {
      char src[40];
      char dest[100];
      strcpy(src, "This is tutorialspoint.com");
      strcpy(dest, src);
      printf("Final copied string : %s\n", dest);
      return(0);
}
```

Output:

Final copied string : This is tutorialspoint.com

Strlen Fonksiyonu


```
int strlen(const char *str)
{
  int len = 0;

  while(*str++)
      len++;

  return len;
} /* end-strlen */
```

Strlen Fonksiyonu


```
#include <stdio.h>
#include <string.h>
int main () {
      char str[50];
      int len;
      strcpy(str, "This is tutorialspoint.com");
      len = strlen(str);
      printf("Length of |%s| is |%d|\n", str, len);
      return(0);
}
```

Output:

```
Length of |This is tutorialspoint.com| is |26|
```

Strcat Fonksiyonu


```
char *strcat(char *str1, const char *str2)
{
  char *p = str1;

  while(*p)
      p++;

  while(*str2)
      *p++ = *str2++;

  *p = '\0';
  return str1;
} /* end-strcat */
```

Strcat Fonksiyonu


```
#include <stdio.h>
#include <string.h>
int main () {
        char src[50],
        dest[50];
        strcpy(src, "This is source");
        strcpy(dest, "This is destination");
        strcat(dest, src);
        printf("Final destination string : |%s|", dest);
        return(0);
}
```

Output:

Final destination string : |This is destinationThis is source|

Strcmp Fonksiyonu


```
int strcmp(const char *str1, const char *str2)
{
  while (*str1 && *str2 && *str1 == *str2){
    str1++; str2++;
  } /* end-while */

  return *str1-*str2;
} /* end-strcmp */
```

Strcmp Fonksiyonu


```
#include <stdio.h>
#include <string.h>
int main () {
        char str1[15], str2[15];
        int ret;
        strcpy(str1, "abcdef");
        strcpy(str2, "ABCDEF");
        ret = strcmp(str1, str2);
        if(ret < 0)
                printf("str1 is less than str2");
        else if(ret > 0)
                printf("str2 is less than str1");
        else
                printf("str1 is equal to str2");
        return(0);
}
```

Output:

str2 is less than str1

Sorting

- Placing a group of data in descending or ascending order.
- Sorting data is very useful for computer systems.
- Makes searching and listing a group of data faster and easier.
- Most popular sorting algorithms:
  - Insertion sort
  - Selection sort
  - Bubble sort
  - Quick sort

Bubble Sort

- Time complexity is $O(n^2)$
- If c number of item of n items is not sorted time complexity is O(c n)
- Design of algorithm is easy, but algorithm is not efficient.
- Can be used for small size lists or lists having mostly sorted items.

Bubble Sort

Array to be sorted : [7,3,5,1,2]

• Hareket 1- Çevrim-1 [3,7,5,1,2] • Hareket 1- Çevrim-2 [3,5,7,1,2] • Hareket 1- Çevrim-3 [3,5,1,7,2] • Hareket 1- Çevrim-4 [3,5,1,2,7]	• Hareket 2- Çevrim-1 [3,5,1,2,7] • Hareket 2- Çevrim-2 [3,1,5,2,7] • Hareket 2- Çevrim-3 [3,1,2,5,7] • Hareket 2- Çevrim-4 [3,1,2,5,7]	• Hareket 3- Çevrim-1 [1,3,2,5,7] • Hareket 3- Çevrim-2 [1,2,3,5,7] • Hareket 3- Çevrim-3 [1,3,2,5,7] • Hareket 3- Çevrim-4 [1,3,2,5,7]	• Hareket 4- Çevrim-1 [1,3,2,5,7] • Hareket 4- Çevrim-2 [1,2,3,5,7] • Hareket 4- Çevrim-3 [1,2,3,5,7] • Hareket 4- Çevrim-4 **[1,2,3,5,7]**

Bubble Sort


```
26  void bubbleSort(int dizi[],int n)
27  {
28      int gecici;
29
30      for (int i = 0; i < n; i++)
31      {
32          for (int k = 0; k < n - 1 - i; k++)
33          {
34              if(dizi[k]>dizi[k+1])
35              {
36                  gecici=dizi[k];
37                  dizi[k] = dizi[k + 1];
38                  dizi[k + 1] = gecici;
39              }
40          }
41      }
42  }
```

(n-1);

Bubble Sort


```c
#include <stdio.h>

void bubbleSort(int [],int);
int main(void)
{
    int i=0,a[5];
    printf("Siralamak istediğin 5 sayi gir\n");
    while(i<5){
        scanf("%d",&a[i]);
        i++;
    }
    i=0;
    bubbleSort(a,5);

    printf("Bubble sort isleminden sonra...\n");
    while(i<5){
        printf("%d ",a[i]);
        i++;
    }
    return 0;
}
```

Insertion Sort

- Appropriate for inserting an item into an already sorted list of data.
- Complexity of inserting an item into an already sorted list of data: O (n)
- If list or array is not sorted complexity: O (n^2)

Insertion Sort

Array to be sorted : [7,3,5,8,2]

Initial state : [7][3,5,8,2]

Before	After
[7,3][5,8,2]	[3,7][5,8,2]
[3,7,5][8,2]	[3,5,7][8,2]
[3,5,7,8][2]	[3,5,7,8][2]
[3,5,7,8,2][ ]	[2,3,5,7,8][ ]

Insertion Sort


```
23  void insertionSort(int dizi[], int n)
24  {
25      int ekle,k,i;
26      for (i = 1; i < n; i++)
27      {
28          ekle = dizi[i];
29          for (k = i - 1; k >= 0 && ekle <= dizi[k]; k--)
30              dizi[k + 1] = dizi[k]; //Geriye kaydırma
31          dizi[k + 1] = ekle;         //Uygun yer boşaltıldı eklendi
32      }
33  }
```

Insertion Sort


```c
#include <stdio.h>

void insertionSort(int [],int);
int main(void)
{
    int i=0,a[5];
    printf("Siralamak istediğin 5 sayi gir\n");
    while(i<5){
        scanf("%d",&a[i]);
        i++;
    }
    i=0;
    insertionSort(a,5);

    printf("Insertion sort isleminden sonra...\n");
    while(i<5){
        printf("%d ",a[i]);
        i++;
    }
    return 0;
}
```

Selection Sort

- If an item is in its true place it does not change its order.
- Change of items is less in half sorted group of data.
- Take the first item in the list and exchange with the minimum item of others.

  Repeat this until the last item.

Before	After	
`[][7,3,5,1,2]`	`[1][3,5,7,2]`	`1 and 7 exchanged`
`[1][3,5,7,2]`	`[1,2][5,7,3]`	`2 and 3 exchanged`
`[1,2][5,7,3]`	`[1,2,3][7,5]`	`3 and 5 exchanged`
`[1,2,3][7,5]`	`[1,2,3,5][7]`	`5 and 7 exchanged`
`[1,2,3,5][7]`	`[1,2,3,5,7][]`	`end`

Selection Sort


```
25  void selectionSort(int dizi[],int n)
26  {
27      int i,j;
28      int index, enkucuk;
29      for (i = 0; i < n - 1; i++)
30      {
31          enkucuk = dizi[n - 1];
32          index = n - 1;
33          for (j = i; j < n - 1; j++)
34          {
35              if (dizi[j] < enkucuk)
36              {
37                  enkucuk = dizi[j];
38                  index = j;
39              }
40          }
41          dizi[index] = dizi[i];
42          dizi[i] = enkucuk;
43      }
44  }
```

Selection Sort


```c
#include <stdio.h>

void selectionSort(int [],int);
int main(void)
{
    int i=0,a[5];
    printf("Siralamak istediğin 5 sayi gir\n");
    while(i<5){
        scanf("%d",&a[i]);
        i++;
    }
    i=0;
    selectionSort(a,5);

    printf("Selection sort isleminden sonra...\n");
    while(i<5){
        printf("%d ",a[i]);
        i++;
    }
    return 0;
}
```

Search

- The process of finding a particular element of an array is called searching.
- Two searching techniques will be discussed
  - Linear Search
  - Binary Search

Linear Search

- Compares each element of the array with the search key.
- Since the array is not in any particular order, it is just as likely that the value will be found in the first element as in the last.
- In the worst case with N number of elements, the algorithm's complexity is O(N)
- It should not be used in large size arrays.

Linear Search


```
21  int linearSearch(int dizi[],int aranan,int n)
22  {
23      for (int i = 0; i < n; i++)
24      {
25          if (dizi[i] == aranan)
26              return i;
27      }
28      return -1;
29  }
```

Linear Search


```c
#include <stdio.h>

int linearSearch(int [],int,int);
int main(void)
{
    int dizi[] = { 1, 3, 5, 7, 8, 10, 11 };
    int sonuc, aranan,i;
    for (i = 0; i < 7; i++)
        printf("%d ",dizi[i]);

    printf("Arananı giriniz:");
    scanf("%d",&aranan);

    sonuc = linearSearch(dizi, aranan,7);
    if (sonuc == -1)
        printf("\nAranan dizide yok\n");
    else
        printf(sonuc + ". sırada bulundu\n");
}
```

Next Week

- Struct, Enum and Typedef
- Singly Linked Linear Lists

References

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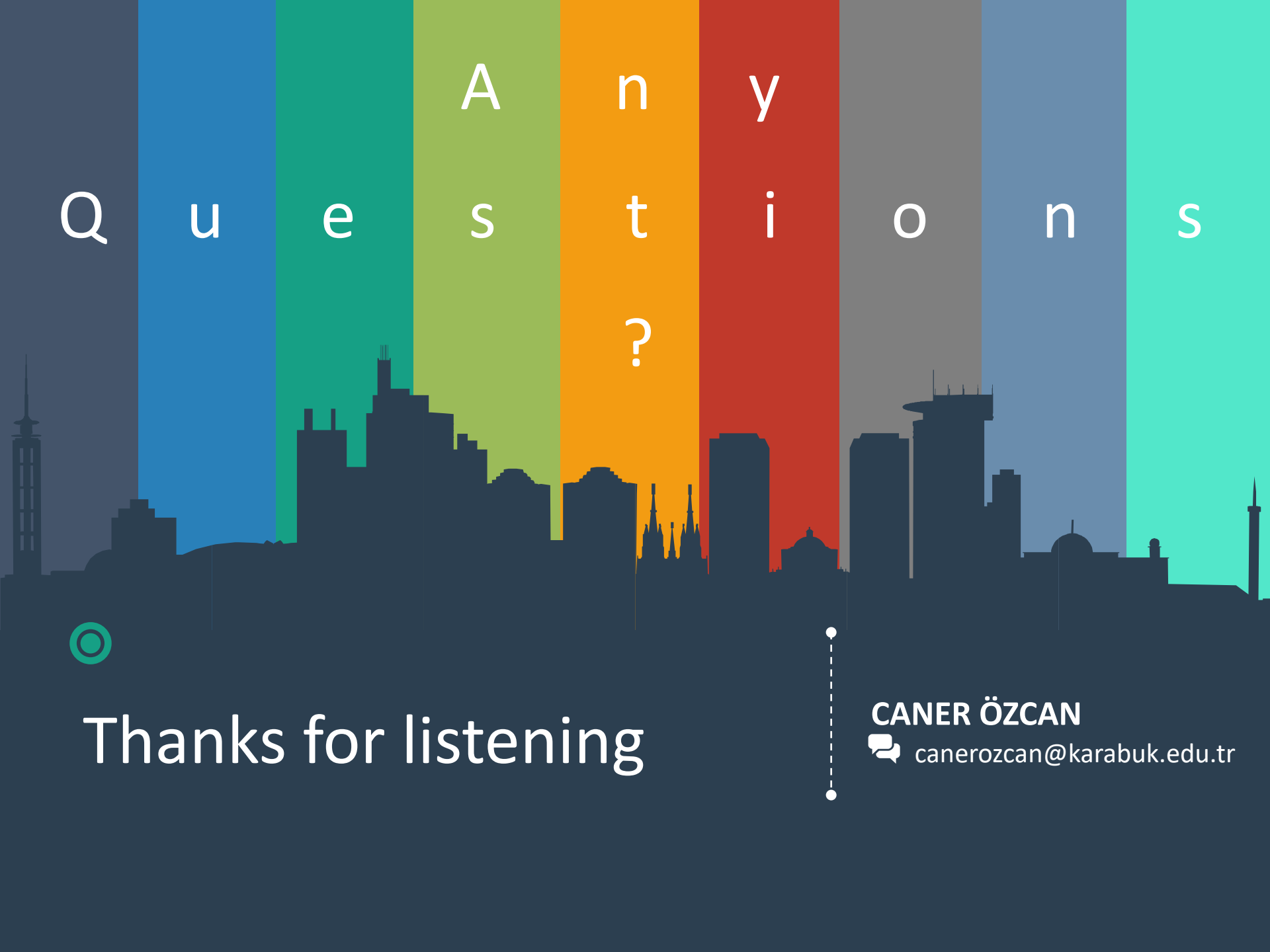

Thanks for listening

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Dip not..

Aklınızla, bedeninizle masanın başında oturup okumanızı tavsiye ederim.
Okumanız, düşünmeniz ve
düşünüp fikirlerinizi geliştirmeniz
gerekmektedir.

Prof. Dr. Fuat Sezgin