CME 112- Programming Languages II

Week 9
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);`
strncpy Fonksiyonu

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

    while (*str2) {
        *p++ = *str2++;
    }
    *p = '\0';
    return str1;
}
/* end-strncpy */
```
Strcpy Fonksiyonu

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

    while(*str++)
        len++;

    return len;
} /* end-strlen */
#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|
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

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

    return *str1-*str2;
} /* end-strcmp */
**Strcmp Fonksiyonu**

```c
#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
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.

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>[] [7, 3, 5, 1, 2]</td>
<td>[1] [3, 5, 7, 2]</td>
<td>1 and 7 exchanged</td>
</tr>
<tr>
<td>[1] [3, 5, 7, 2]</td>
<td>[1, 2] [5, 7, 3]</td>
<td>2 and 3 exchanged</td>
</tr>
<tr>
<td>[1, 2] [5, 7, 3]</td>
<td>[1, 2, 3] [7, 5]</td>
<td>3 and 5 exchanged</td>
</tr>
<tr>
<td>[1, 2, 3] [7, 5]</td>
<td>[1, 2, 3, 5] [7]</td>
<td>5 and 7 exchanged</td>
</tr>
<tr>
<td>[1, 2, 3, 5] [7]</td>
<td>[1, 2, 3, 5, 7] [][]</td>
<td>end</td>
</tr>
</tbody>
</table>
Selection Sort

```c
void selectionSort(int dizi[], int n)
{
    int i, j;
    int enkucuk, index;
    for (i = 0; i < n - 1; i++)
    {
        enkucuk = dizi[n - 1];
        index = n - 1;
        for (j = i; j < n - 1; j++)
        {
            if (dizi[j] < enkucuk)
            {
                enkucuk = dizi[j];
                index = j;
            }
        }
        dizi[index] = dizi[i];
        dizi[i] = enkucuk;
    }
}
```
```c
#include <stdio.h>

void selectionSort(int [], int);

int main(void)
{
    int i = 0, a[5];
    printf("Siralamak istedIGIN 5 sayi gir\n");
    while (i < 5)
    {
        scanf("%d", &a[i]);
        i++;
    }
    i = 0;
    selectionSort(a, 5);
    printf("Selection sort islemininden sonra...\n");
    while (i < 5)
    {
        printf("%d ", a[i]);
        i++;
    }
    return 0;
}
```
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

```c
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 + ". sıradada bulundu\n");
}
```
Next Week

- File Operations
- Sequential Access Files
References


► Paul J. Deitel, “C How to Program”, Harvey Deitel.

► “A book on C”, All Kelley, İra Pohl
Any Questions?

Thanks for listening

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