

Programming with C I

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Arrays of Pointers



As seen in the last example, sorting an array of strings requires swapping the strings which can require copying a lot of data. For efficiency, it is better to avoid actual swapping of data whenever a data item is large, such as a string or an entire data base record.

Arrays of Pointers

➤ Consider some examples:




- `int data1, data2, *ptr1, *ptr2, *save;`
 - `data1 = 100; data2 = 200;`
 - `ptr1 = &data1; ptr2 = &data2;`



We could swap the values of the data and store the swapped values in `data1` and `data2` or we could simply swap the values of the pointers:

- `save = ptr1`
- `ptr1 = ptr2;`
- `ptr2 = save;`

Arrays of Pointers

-  In general, an array of pointers can be used to point to an array of data items with each element of the pointer array pointing to an element of the data array. Data items can be accessed either directly in the data array, or indirectly by dereferencing the elements of the pointer array.
-  The advantage of a pointer array is that the pointers can be reordered in any manner without moving the data items.
-  This approach saves a lot of time, with the additional advantage that the data items remain available in the original order.

Arrays of Pointers

- Let us see how we might implement such a scheme.
- STRPTRS:** Given an array of strings, use pointers to order the strings in sorted form, leaving the array unchanged.
- We will use an array of character pointers to point to the strings declared as follows:
 - `char * flowerptr[MAX];`**

Arrays of Pointers



It is also possible to assign the value of any string pointer to `flowerptr[i]`; for example, if `s` is a string, then it is possible to assign the pointer value `s` to `flowerptr[i]`:

- **`flowerptr[i] = s;`**



In particular, we can read strings into a two dimensional array, `flowers[][]`, and assign each string pointer, `flowers[i]` to the element of the pointer array, `flowersptr[i]`:

- **`for (i = 0; i < MAX; i++)`**
- **`flowerptr[i] = flowers[i];`**

Arrays of Pointers

- 🛡️ The strings can then be accessed either by `flowers[i]` or by `flowerptr[i]`.
- 🛡️ We can then reorder the pointers in `flowerptr[]` so that they successively point to the strings in sorted order.
- 🛡️ We can then print the strings in the original order by accessing them through `flowers[i]` and print the strings in sorted order by accessing them through `flowerptr[i]`.

Arrays of Pointers

flowers

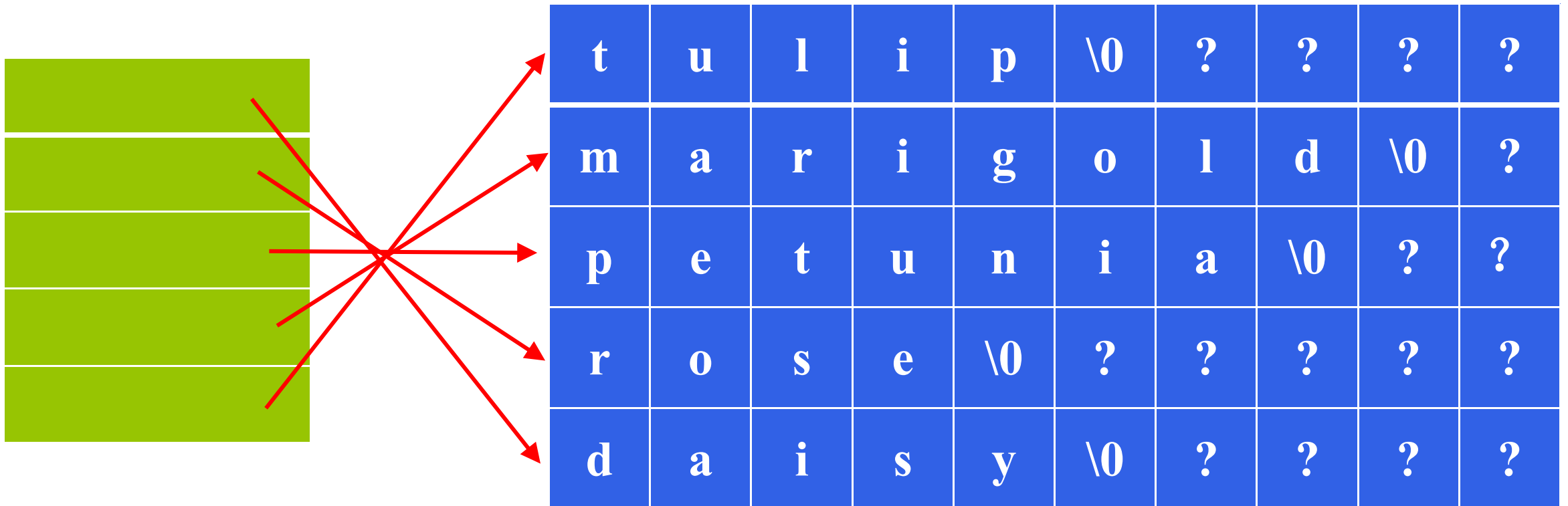
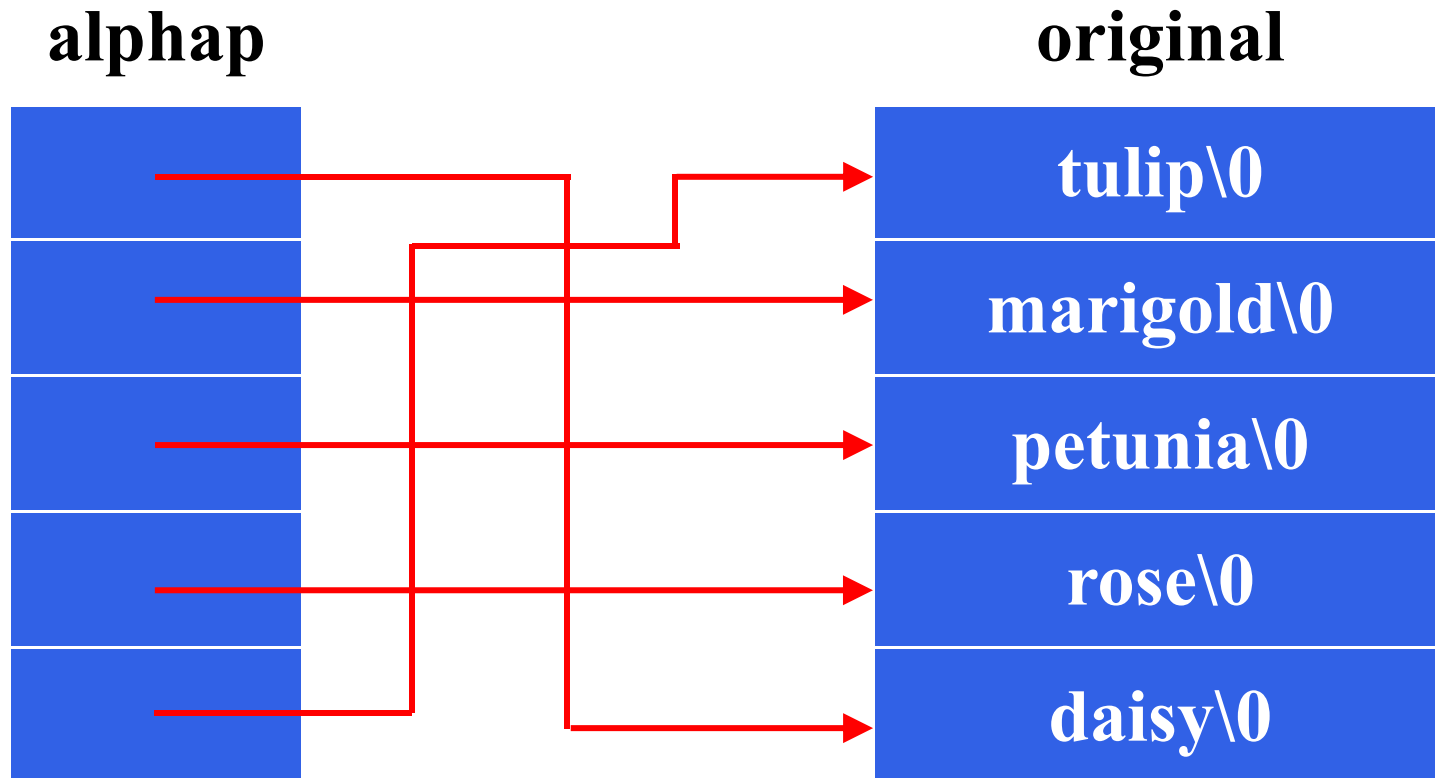


Figure An Array of Pointers



Driver for Sorting Pointer Array Program

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

#define NUM_FLOWERS 5
#define MAX_LEN 20

void selectionSort(char *flowerptr[], int n) {
    int i, j;
    char *temp;

    for (i = 0; i < n - 1; i++) {
        int minIndex = i;
        for (j = i + 1; j < n; j++) {
            if (strcmp(flowerptr[j], flowerptr[minIndex]) < 0) {
                minIndex = j;
            }
        }
        if (minIndex != i) {
            // Swap pointers in flowerptr array
            temp = flowerptr[minIndex];
            flowerptr[minIndex] = flowerptr[i];
            flowerptr[i] = temp;
        }
    }
}
```

Code for sortptrs()

```
int main() {
    // Two-dimensional array of flower names
    char flowers[NUM_FLOWERS][MAX_LEN] = {"tulip", "marigold", "petunia", "rose", "daisy"};

    // Array of pointers to strings
    char *flowerptr[NUM_FLOWERS];

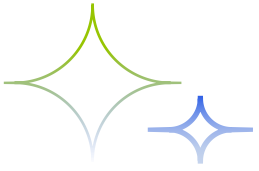
    // Assign each string pointer to the corresponding element of the pointer array
    for (int i = 0; i < NUM_FLOWERS; i++) {
        flowerptr[i] = flowers[i];
    }

    // Print original order
    printf("Original order:\n");
    for (int i = 0; i < NUM_FLOWERS; i++) {
        printf("%s ", flowers[i]);
    }
    printf("\n");

    // Sort the flower pointers
    selectionSort(flowerptr, NUM_FLOWERS);

    // Print sorted order
    printf("\nSorted order:\n");
    for (int i = 0; i < NUM_FLOWERS; i++) {
        printf("%s ", flowerptr[i]);
    }
    printf("\n");

    return 0;
}
```



THE END

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