Chapter 3: Arrays and Strings (programs)

4.1 One dimension, two dimension, and multidimensional arrays:

```c
#include <stdio.h>

int main() {
    // One-dimensional array
    int numbers[5] = {1, 2, 3, 4, 5};

    // Two-dimensional array
    int matrix[3][3] = { {1, 2, 3}, {4, 5, 6}, {7, 8, 9} };

    // Multidimensional array
    int cube[2][2][2] = { { {1, 2}, {3, 4} }, { {5, 6}, {7, 8} } };

    return 0;
}
```

4.2 Array declaration:

```c
#include <stdio.h>

int main() {
    int numbers[5]; // Declaration of a one-dimensional array

    return 0;
}
```

4.3 Array initialization:

```c
#include <stdio.h>

int main() {
    int numbers[5] = {1, 2, 3, 4, 5}; // Initialization of a one-
dimensional array

    return 0;
}
```

4.4 Calculating the length of an array:

```c
#include <stdio.h>

int main() {
    int numbers[5] = {1, 2, 3, 4, 5};
    int length = sizeof(numbers) / sizeof(numbers[0]);

    printf("Length of the array: %d\n", length);

    return 0;
}
```

4.5 Operations on an array:

```c
#include <stdio.h>

int main() {
    int numbers[5] = {1, 2, 3, 4, 5};

    // Accessing elements
    int firstElement = numbers[0];
    printf("First element: %d\n", firstElement);
```

```
    // Modifying elements
    numbers[1] = 10;

    // Traversing through the array
    for (int i = 0; i < 5; i++) {
        printf("Element at index %d: %d\n", i, numbers[i]);
    }

    return 0;
}
```

4.6 String input/output:

```
#include <stdio.h>

int main() {
    char name[20];

    // String input
    printf("Enter your name: ");
    scanf("%s", name);

    // String output
    printf("Hello, %s!\n", name);

    return 0;
}
```

4.7 String operations:

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

int main() {
    char str1[20] = "Hello";
    char str2[20] = "World";

    // Concatenation
    strcat(str1, " ");
    strcat(str1, str2);
    printf("Concatenated string: %s\n", str1);

    // Substring
    char substring[10];
    strncpy(substring, str1 + 6, 5);
    substring[5] = '\0';
    printf("Substring: %s\n", substring);

    // Length
    int length = strlen(str1);
    printf("Length of the string: %d\n", length);

    // Searching
    char searchChar = 'o';
    char* searchResult = strchr(str1, searchChar);
    printf("First occurrence of '%c': %s\n", searchChar, searchResult);

    // Replacement
    char* replaceResult = strstr(str1, "World");
    strncpy(replaceResult, "Universe", 8);
    printf("Replaced string: %s\n", str1);

    return 0;
}
```

4.8 Array of strings:

```c
#include <stdio.h>

int main() {
    char names[3][20] = {"John", "Mary", "Tom"};

    // Accessing elements
    printf("First name: %s\n", names[0]);

    // Modifying elements
    strcpy(names[1], "Alice");

    // Traversing through the array
    for (int i = 0; i < 3; i++) {
        printf("Name: %s\n", names[i]);
    }

    return 0;
}
```