

General Questions

1. **Why did you select these specific programs for your practical file?**
 - These programs cover fundamental concepts of C programming such as control structures, loops, arrays, functions, and operations on strings and numbers. They provide a solid understanding of programming basics.
 2. **Can you explain the structure of a C program?**
 - A C program typically starts with the inclusion of necessary header files, followed by the `main()` function where execution starts. Inside the `main()` function, the program logic is implemented using variables, functions, control structures, loops, and statements.
 3. **What is the importance of functions in programming?**
 - Functions allow code to be modular, reusable, and easier to manage. They help break down complex tasks into simpler, manageable blocks, enhancing readability and maintainability.
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Program-Specific Questions

1. Celsius to Fahrenheit Conversion

- **What is the formula for converting Celsius to Fahrenheit?**
 - The formula is: $\text{Fahrenheit} = (\text{Celsius} \times 9/5) + 32$.
- **Why did you use float for the variables?**
 - Since temperature values may have decimal points, using float ensures that the conversion calculation is accurate, including any fractional values.

2. Greatest Among Three Numbers

- **How does the if-else ladder work in this program?**
 - The if-else ladder compares three numbers (a, b, c) to determine the greatest. Each condition checks whether one number is greater than the others and prints the greatest one.
- **What happens if two or more numbers are equal?**
 - The program still correctly identifies one of the numbers as the greatest, depending on the logic of the if-else structure.

3. Size of Data Types

- **What are the sizes of basic data types like int, float, and double?**
 - The size of data types can vary depending on the platform, but generally:
 - int is 4 bytes
 - float is 4 bytes

- double is 8 bytes
- char is 1 byte
- **How does the size of a data type vary across platforms?**
 - The size of data types like int or float can vary depending on the system architecture (32-bit vs 64-bit systems) or the compiler being used.

4. Vowel or Consonant

- **How does the program differentiate between uppercase and lowercase characters?**
 - The program converts the character to lowercase using the `tolower()` function to handle both uppercase and lowercase vowels and consonants.
- **What library functions are used for character classification?**
 - The `isalpha()` function checks if the character is an alphabet, and `tolower()` is used to convert the character to lowercase.

5 & 6. Patterns (Inverse Triangle & Pyramid)

- **How do nested loops work in pattern printing?**
 - Nested loops allow you to control the flow of printing characters. For example, the outer loop controls the number of rows, while the inner loop prints spaces or characters for each row.
- **Can you modify the program to print a diamond pattern?**
 - Yes, by adjusting the loop structure to print decreasing and increasing characters, a diamond pattern can be formed.

7. Average Marks of 50 Students

- **Why did you use arrays in this program?**
 - Arrays are used to store the marks of all 50 students, making it easier to calculate the sum and average.
- **What is the difference between sum and average in the program?**
 - sum is the total of all students' marks, and average is the sum divided by the number of students (50).

8. Factorial Calculation

- **What is the limitation of calculating factorial for large numbers in C?**
 - Factorial values grow exponentially, so for large numbers (greater than 20), the value exceeds the storage capacity of standard data types like `long long int`.
- **How can recursion be used for factorial calculation?**
 - A recursive function calls itself with a reduced argument until it reaches the base case (factorial of 1 or 0).

9. Counting Characters in a String

- **What is the purpose of strlen in the program?**
 - The strlen() function is used to calculate the length of a string (excluding the null terminator).
- **How does the program handle spaces in the string?**
 - The program counts all characters, including spaces, since strlen() counts all characters until it encounters the null terminator.

10. Smallest Value Among Three Numbers

- **Can the program find the smallest of more than three numbers?**
 - Yes, by extending the logic with more variables or using loops to input additional numbers, the program can be adapted to find the smallest value in a larger set.

11 & 14. Compound & Simple Interest

- **What are the formulas for compound and simple interest?**
 - Simple Interest: $SI = (P \times R \times T) / 100$
 - Compound Interest: $CI = P \times (1 + R/100)^T$
- **How does the pow function work?**
 - The pow function calculates the power of a number. For example, pow(1 + r/100, t) calculates $(1 + r/100)^t$.

15. Size of Data Types

- **What is the difference between sizeof and strlen?**
 - sizeof is a compile-time operator that returns the size of a variable or data type in bytes, while strlen is a runtime function that returns the length of a string (number of characters excluding the null terminator).
- **Why is sizeof a compile-time operator?**
 - sizeof evaluates the size of a variable or data type at compile-time, meaning it doesn't depend on the runtime values of the variables.

16. Sum of Natural Numbers

- **How does a for loop calculate the sum of numbers efficiently?**
 - The for loop iterates through all numbers from 1 to n, adding them to the sum in each iteration.
- **Can this program be implemented using recursion?**
 - Yes, by calling the function recursively with n-1 until it reaches 1, summing the values in each recursive call.

17. Multiplication Table

- **How can you modify the program to display a table in reverse order?**
 - You can modify the loop to start from the highest number and decrease to 1.

18. Swap Two Numbers

- **What is the difference between call by value and call by reference?**
 - In call by value, a copy of the argument is passed, and changes do not affect the original variable. In call by reference, the memory address of the argument is passed, allowing the original value to be modified.
- **How does the * operator work for pointers?**
 - The * operator is used to dereference a pointer, accessing the value at the memory location it points to.

19. Bubble Sort

- **Why is bubble sort considered inefficient for large datasets?**
 - Bubble sort has a time complexity of $O(n^2)$, which makes it inefficient for large datasets. It repeatedly compares and swaps adjacent elements.
- **Can you implement the program using a different sorting algorithm?**
 - Yes, more efficient algorithms like quicksort or mergesort can be used for better performance.

20 & 21. Matrix Operations

- **How do you perform matrix addition and transposition?**
 - Matrix addition is done by adding corresponding elements of two matrices, while matrix transposition involves swapping rows and columns.
- **Can the program handle matrices larger than 2x2?**
 - Yes, the program can be modified to handle larger matrices by adjusting the matrix dimensions and loops accordingly.

22. Factorial Using Recursion

- **How is recursion different from iteration?**
 - Recursion involves the function calling itself, whereas iteration uses loops to repeat actions.
- **What are the base and recursive cases in your function?**
 - The base case is when num is 0 or 1, returning 1. The recursive case is $\text{num} * \text{factorial}(\text{num} - 1)$.

23. Fibonacci Series

- **What is the time complexity of your Fibonacci program?**

- The time complexity of the recursive Fibonacci program is $O(2^n)$, which makes it inefficient for large n .
- **How can you optimize the program using dynamic programming?**
 - Dynamic programming can store previously calculated Fibonacci values to avoid redundant calculations, reducing the time complexity to $O(n)$.

24. Matrix Multiplication

- **What is the condition for matrix multiplication to be valid?**
 - The number of columns in the first matrix must equal the number of rows in the second matrix.
- **Can you modify the program for non-square matrices?**
 - Yes, by modifying the dimensions of the matrices and adjusting the loops to handle different row and column counts.

25. Menu-Driven String Operations

- **How does the program handle user input in the menu?**
 - The program prompts the user to choose an operation and then performs the corresponding string operation based on the user's input.
- **Explain the difference between strcpy, strlen, and strcmp.**
 - strcpy copies one string to another, strlen calculates the length of a string, and strcmp compares two strings for equality.

Explanation of String Operations Program

Program Overview

The string operations program provides a **menu-driven interface** to perform various string manipulations such as:

1. Calculating the length of a string.
2. Concatenating one string to another.
3. Copying one string to another.
4. Comparing two strings for equality.

Key Features of the Program

1. **Menu-Driven Approach:**
 - The user selects an operation by entering a choice.
 - Each case in the switch statement executes the corresponding operation.
2. **String Operations:**
 - **Length Calculation:** Loops through the string until the null character `\0` is encountered, counting each character.

- **Concatenation:** Appends the second string to the end of the first string by iterating through the characters.
 - **Copying:** Copies characters from one string to another using a loop.
 - **Comparison:** Compares two strings character by character. If all characters match, the strings are equal.
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Program Flow Explanation

c

Copy code

```
do {  
    printf("\nMenu:\n");  
    printf("1. Calculate length of a string\n");  
    printf("2. Concatenate at the end of a given string\n");  
    printf("3. Copy one string to another\n");  
    printf("4. Compare contents of two strings\n");  
    printf("5. Exit\n");  
    printf("Enter your choice: ");  
    scanf("%d", &choice);  
  
    switch (choice) {  
        case 1: // Length Calculation  
            printf("Enter a string: ");  
            scanf("%s", str1);  
            for (i = 0; str1[i] != '\0'; i++);  
            printf("Length of the string: %d\n", i);  
            break;  
  
        case 2: // Concatenation  
            printf("Enter the first string: ");  
            scanf("%s", str1);  
            printf("Enter the second string to concatenate: ");  
            scanf("%s", str2);
```

```
for (i = 0; str1[i] != '\0'; i++);  
for (j = 0; str2[j] != '\0'; j++, i++) {  
    str1[i] = str2[j];  
}  
str1[i] = '\0';  
printf("Concatenated string: %s\n", str1);  
break;
```

case 3: // Copying

```
printf("Enter a string to copy: ");  
scanf("%s", str1);  
for (i = 0; str1[i] != '\0'; i++) {  
    str2[i] = str1[i];  
}  
str2[i] = '\0';  
printf("Copied string: %s\n", str2);  
break;
```

case 4: // Comparison

```
printf("Enter the first string: ");  
scanf("%s", str1);  
printf("Enter the second string: ");  
scanf("%s", str2);  
for (i = 0; str1[i] != '\0' && str2[i] != '\0'; i++) {  
    if (str1[i] != str2[i]) {  
        break;  
    }  
}  
if (str1[i] == '\0' && str2[i] == '\0') {  
    printf("Strings are equal\n");  
} else {
```

```

        printf("Strings are not equal\n");
    }

    break;

case 5: // Exit
    printf("Exiting program.\n");
    break;

default:
    printf("Invalid choice. Try again.\n");
}
} while (choice != 5);

```

Call by Reference vs Call by Address

Call by Reference

- **Definition:** The function receives the actual reference (or memory address) of the variable. Changes made inside the function are reflected in the original variable.
- **Example:**

c

Copy code

```

void swap(int *x, int *y) {
    int temp = *x;
    *x = *y;
    *y = temp;
}

int main() {
    int a = 5, b = 10;

    swap(&a, &b); // Passes memory addresses of a and b

    printf("a = %d, b = %d", a, b); // Swapped values
}

```

- **Advantages:**

1. Allows the function to modify the original variables.
2. Efficient for passing large data structures as only the reference is passed.

Call by Address

- **Definition:** Similar to call by reference, but explicitly uses pointers to pass the address of variables.
- **Example:**

C

Copy code

```
void printAddress(int *x) {  
    printf("Address of variable: %p\n", x);  
}  
  
int main() {  
    int num = 20;  
    printAddress(&num); // Passes the address of num  
}
```

Key Differences

Aspect	Call by Reference	Call by Address
Syntax	Uses references directly (in languages like C++).	Uses pointers explicitly in C.
Data Passed	Reference to the variable.	Memory address of the variable.
Modification	Changes affect the original variable.	Changes affect the original variable.
Use Case	Useful for modifying variables and passing large objects.	Used for operations requiring memory addresses.

Pointers in C Programming

Definition

A pointer is a variable that stores the **memory address** of another variable. Instead of holding a direct value, it "points" to the location of the value in memory.

Why Use Pointers?

1. **Efficient Memory Access:** Allows direct access to memory locations.
 2. **Dynamic Memory Allocation:** Used with malloc, calloc, and free to manage memory dynamically.
 3. **Pass by Reference:** Enables modifying variables in functions without returning them.
 4. **Efficient Data Structures:** Used to implement linked lists, trees, graphs, and other data structures.
-

Pointer Basics

1. Declaring a Pointer

c

Copy code

```
int *ptr; // Declares a pointer to an integer
```

- *: Indicates it's a pointer.
- ptr: The name of the pointer.

2. Assigning Address

c

Copy code

```
int a = 10;
```

```
int *ptr = &a; // 'ptr' holds the address of 'a'
```

3. Dereferencing a Pointer

- Access the value stored at the memory address using * (dereference operator):

c

Copy code

```
printf("Value of a: %d", *ptr); // Outputs 10
```

4. Pointer Example

c

Copy code

```
int x = 5;

int *p = &x;

printf("Address of x: %p\n", p); // Prints the address of x
printf("Value of x: %d\n", *p); // Prints the value of x (5)
```

Pointer Operations

Pointers allow several operations:

1. Assignment

c

Copy code

```
int a = 5, b = 10;

int *p = &a;

p = &b; // Now 'p' points to 'b'
```

2. Increment/Decrement

- Move to the next/previous memory location (valid for arrays):

c

Copy code

```
int arr[3] = {10, 20, 30};

int *p = arr; // Points to arr[0]

p++;          // Points to arr[1]

printf("%d", *p); // Outputs 20
```

3. Comparison

- Compare addresses:

c

Copy code

```
if (p1 == p2) { /* Check if both pointers point to the same address */ }
```

Pointer Types

1. Null Pointer

- A pointer that doesn't point to any valid memory location.

c

Copy code

```
int *ptr = NULL;
if (ptr == NULL) {
    printf("Pointer is null.\n");
}
```

2. Void Pointer

- A generic pointer that can point to any data type.

c

Copy code

```
void *ptr;
int a = 10;
ptr = &a;
printf("Value: %d\n", *(int *)ptr); // Cast to appropriate type
```

3. Function Pointer

- Points to a function instead of a variable.

c

Copy code

```
void greet() {
    printf("Hello, World!");
}

void (*funcPtr)() = greet; // Assign function address
funcPtr(); // Calls greet()
```

Pointers and Arrays

1. Accessing Array Elements Using Pointers

c

Copy code

```
int arr[] = {10, 20, 30};
int *p = arr; // Points to arr[0]
```

```
printf("%d", *(p + 1)); // Outputs 20 (arr[1])
```

2. Pointer Arithmetic

- Incrementing a pointer moves it to the next memory location.

c

Copy code

```
int arr[3] = {1, 2, 3};
```

```
int *p = arr;
```

```
printf("%d", *(p + 2)); // Outputs 3
```

Dynamic Memory Allocation

Pointers are essential for managing memory dynamically.

1. Using malloc

c

Copy code

```
int *ptr = (int *)malloc(sizeof(int)); // Allocates memory for 1 int
```

```
*ptr = 42; // Assign value
```

2. Freeing Memory

c

Copy code

```
free(ptr); // Deallocates memory
```

3. Using calloc

c

Copy code

```
int *arr = (int *)calloc(5, sizeof(int)); // Allocates space for 5 integers
```

Common Pointer Errors

1. Dereferencing a Null Pointer

- Accessing a null pointer leads to undefined behavior:

c

Copy code

```
int *ptr = NULL;
```

```
printf("%d", *ptr); // Error!
```

2. Dangling Pointer

- A pointer pointing to deallocated memory:

c

Copy code

```
int *ptr = (int *)malloc(sizeof(int));  
free(ptr);  
printf("%d", *ptr); // Undefined behavior
```

3. Memory Leaks

- Forgetting to free dynamically allocated memory.

Example: Swapping Two Numbers Using Pointers

c

Copy code

```
void swap(int *x, int *y) {  
    int temp = *x;  
    *x = *y;  
    *y = temp;  
}  
  
int main() {  
    int a = 10, b = 20;  
    swap(&a, &b); // Passing addresses of a and b  
    printf("a = %d, b = %d", a, b); // Outputs: a = 20, b = 10  
    return 0;  
}
```

Basic Concepts

1. **What is the difference between a variable and a constant?**
 - A **variable** is a named storage for data that can be changed during program execution.
 - A **constant** is a fixed value that cannot be altered during the program's execution, declared using `#define` or `const`.
 2. **What are the basic data types in C?**
 - Common data types:
 - `int` (integer)
 - `float` (floating-point)
 - `double` (double-precision floating-point)
 - `char` (character)
 3. **What is the purpose of the `main()` function in C?**
 - The `main()` function is the entry point of a C program where execution begins.
-

Control Structures

1. **What are the types of loops in C?**
 - **for loop**: Used when the number of iterations is known.
 - **while loop**: Executes as long as the condition is true.
 - **do-while loop**: Executes at least once before checking the condition.
 2. **What is the difference between `break` and `continue`?**
 - `break`: Exits the loop or switch case immediately.
 - `continue`: Skips the current iteration and moves to the next iteration.
 3. **What is the difference between `if-else` and `switch`?**
 - `if-else`: Evaluates expressions and supports relational and logical conditions.
 - `switch`: Works with constant values (like integers or characters) and is more efficient for multiple conditions.
-

Functions

1. **What are the types of functions in C?**
 - Library functions (e.g., `printf`, `scanf`).
 - User-defined functions (functions created by the programmer).

2. What is recursion?

- Recursion is when a function calls itself to solve a problem. Example: Factorial calculation.

3. What is the difference between call by value and call by reference?

- **Call by value:** Sends a copy of the variable. Changes inside the function do not affect the original variable.
 - **Call by reference:** Sends the memory address of the variable, allowing changes to the original variable.
-

Arrays and Strings

1. What is the difference between an array and a pointer?

- **Array:** Fixed-size data structure storing multiple elements of the same type.
- **Pointer:** A variable that stores the memory address of another variable.

2. How is a string stored in C?

- A string is stored as an array of characters terminated by a null character (`\0`).

3. What are multi-dimensional arrays?

- Arrays with more than one index, like matrices (`int arr[3][3];`).
-

Memory Management

1. What are dynamic memory allocation functions in C?

- `malloc()`: Allocates memory.
- `calloc()`: Allocates and initializes memory.
- `realloc()`: Resizes allocated memory.
- `free()`: Deallocates memory.

2. What is the difference between stack and heap memory?

- **Stack:** Used for static memory allocation (local variables, function calls).
 - **Heap:** Used for dynamic memory allocation (using `malloc`, `calloc`).
-

Pointers

1. What is the null pointer?

- A pointer that does not point to any valid memory address (`int *ptr = NULL;`).

2. What are wild pointers?

- Uninitialized pointers that may point to arbitrary memory locations.

3. How can pointers be used with arrays?

- Array elements can be accessed using pointers:

c

Copy code

```
int arr[] = {1, 2, 3};  
int *ptr = arr;  
printf("%d", *(ptr + 1)); // Outputs 2
```

Structures and Unions

1. What is a structure in C?

- A user-defined data type that groups related variables of different data types.

c

Copy code

```
struct Student {  
    int id;  
    char name[50];  
    float marks;  
};
```

2. What is the difference between a structure and a union?

- **Structure:** Allocates separate memory for each member.
- **Union:** Shares memory among all members, with the size being the largest member.

File Handling

1. What are the different modes in file handling?

- r: Read mode.
- w: Write mode.
- a: Append mode.
- rb, wb, ab: Binary modes.

2. How do you read and write to a file in C?

- **Reading:**

c

Copy code

```
FILE *fp = fopen("file.txt", "r");
```

```
char c = fgetc(fp);
```

```
fclose(fp);
```

- **Writing:**

c

Copy code

```
FILE *fp = fopen("file.txt", "w");
```

```
fprintf(fp, "Hello, World!");
```

```
fclose(fp);
```

Miscellaneous

1. What are preprocessors in C?

- Directives processed before compilation, like #include, #define.

2. What is the difference between exit() and return?

- exit(): Terminates the program immediately.
- return: Ends the execution of the current function and optionally returns a value.

3. What is typecasting in C?

- Converting one data type into another explicitly.

c

Copy code

```
float f = 3.14;
```

```
int a = (int)f; // a becomes 3
```

4. What is the purpose of sizeof?

- Returns the size of a variable or data type in bytes.

If you share specific topics from your syllabus, I can refine these questions further!

4o

You said:

According to bca 1st year syllabus

UNITWISE:

Unit 1: Basics of C

1. What is C?

- C is a general-purpose, procedural programming language developed by Dennis Ritchie in 1972. It is widely used for system programming and building applications.

2. What are keywords in C?

- Keywords are reserved words in C with predefined meanings, such as int, float, return, etc. There are 32 keywords in C.

3. What is the difference between a compiler and an interpreter?

- **Compiler:** Translates the entire source code into machine code before execution (e.g., GCC for C).
- **Interpreter:** Translates and executes code line by line (e.g., Python).

4. What is the use of the printf and scanf functions?

- printf: Used for output.
 - scanf: Used for input.
-

Unit 2: Control Structures

1. What are the different types of control structures in C?

- **Sequence:** Executes statements in order.
- **Selection:** Includes if, if-else, and switch.
- **Iteration:** Includes for, while, and do-while loops.

2. Explain the difference between while and do-while.

- while: Executes the loop only if the condition is true.
- do-while: Executes at least once, then checks the condition.

3. What is the difference between if and switch?

- if checks conditions using relational or logical operators.
 - switch matches a variable's value against multiple cases.
-

Unit 3: Functions

1. What are the types of functions in C?

- **Library Functions:** Predefined, like printf and sqrt.

- **User-Defined Functions:** Functions created by the programmer.
 - 2. **What is recursion?**
 - Recursion is when a function calls itself. Example: Factorial calculation.
 - 3. **What are the advantages of using functions?**
 - Code modularity, reusability, and ease of debugging.
-

Unit 4: Arrays and Strings

1. **What is an array?**
 - An array is a collection of elements of the same type stored at contiguous memory locations.
 2. **What is the difference between a string and a character array?**
 - A string is a character array terminated by `\0`. A character array may or may not have the null terminator.
 3. **How can you calculate the length of a string?**
 - Using the `strlen()` function or iterating through the string until the null terminator.
 4. **Explain multi-dimensional arrays.**
 - Arrays with more than one dimension (e.g., `int arr[2][3]`; for a 2x3 matrix).
-

Unit 5: Pointers

1. **What is a pointer?**
 - A pointer is a variable that stores the memory address of another variable.
2. **What is the difference between NULL and void pointers?**
 - **NULL pointer:** Points to nothing (address 0).
 - **Void pointer:** Can store the address of any data type but cannot be dereferenced directly.
3. **How do pointers work with arrays?**
 - The array name is a pointer to its first element:

c

Copy code

```
int arr[3] = {10, 20, 30};  
int *p = arr; // p points to arr[0]  
printf("%d", *(p + 1)); // Outputs 20
```

Unit 6: Dynamic Memory Allocation

1. **What are dynamic memory allocation functions in C?**
 - malloc, calloc, realloc, and free.
2. **What is the difference between malloc and calloc?**
 - malloc: Allocates memory without initializing it.
 - calloc: Allocates memory and initializes it to zero.
3. **What is the purpose of the free() function?**
 - To release dynamically allocated memory and prevent memory leaks.

Unit 7: Structures and Unions

1. **What is a structure?**
 - A structure is a user-defined data type that groups different variables under one name:

c

Copy code

```
struct Student {  
    int id;  
    char name[50];  
    float marks;  
};
```

2. **What is the difference between a structure and a union?**
 - In a structure, all members have their own memory space.
 - In a union, all members share the same memory location.
3. **How can you access structure members?**
 - Using the dot operator (.):

c

Copy code

```
struct Student s;  
  
s.id = 101;
```

Unit 8: File Handling

1. What are file handling functions in C?

- Common functions include:
 - fopen, fclose: Open and close files.
 - fgetc, fputc: Read/write characters.
 - fscanf, fprintf: Read/write formatted data.

2. Explain file modes in C.

- Modes include:
 - r: Read
 - w: Write
 - a: Append
 - rb, wb, ab: Binary read/write/append.

3. How can you write data to a file?

- Example:

c

Copy code

```
FILE *fp = fopen("file.txt", "w");  
fprintf(fp, "Hello, World!");  
fclose(fp);
```

Unit 9: Preprocessors and Macros

1. What is the use of preprocessor directives in C?

- Preprocessor directives perform operations before compilation, like including libraries (#include) or defining constants (#define).

2. What is a macro in C?

- A macro is a constant or a piece of code replaced during preprocessing:

c

Copy code

```
#define PI 3.14  
printf("Value of PI: %f", PI);
```

3. What is the purpose of the #ifdef directive?

- It checks if a macro is defined:

c

Copy code

```
#ifdef DEBUG  
printf("Debugging mode enabled");  
#endif
```

Additional Questions

1. What is typecasting in C?

- Converting one data type to another explicitly:

c

Copy code

```
int x = 5;  
float y = (float)x / 2; // Outputs 2.5
```

2. What is the difference between exit() and return?

- return exits from a function, while exit() terminates the program.

3. What is the use of the sizeof operator?

- It returns the size of a variable or data type in bytes:

c

Copy code

```
printf("%d", sizeof(int)); // Outputs 4 (on most systems)
```

4. What is the significance of the \0 character in strings?

- It marks the end of a string in C. Without it, string functions cannot determine where the string ends.