PROJECT REPORT

Project Title: *Warehouse Shelf Tracker*

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Introduction

The Warehouse Shelf Tracker is a basic storage management simulation developed to mimic real-life warehouse slot allocation. Using simple logic, conditions, and arrays, the system keeps track of whether each slot is empty or occupied. This project enhances understanding of arrays, conditional logic, and user input handling in C while demonstrating a real-world use case of inventory management.

Why We Need This

- To maintain organised storage management
- To reduce confusion and human error
- To locate empty or filled slots quickly
- To understand inventory distribution
- To improve efficiency in warehouse operations

. Real-Life Applications

- Warehouse and logistics slot tracking
- Retail store shelf management
- Library book rack monitoring
- Parking lot empty/filled space tracking
- Hospital supply room shelf monitoring
- Manufacturing material storage

PROBLEM DEFINITION

2.1. Goal

To create a simple, reliable console application that simulates the management of a fixed-size warehouse shelf, allowing a user to track the occupancy status of individual storage slots in real-time.

2.2. Functional Requirements

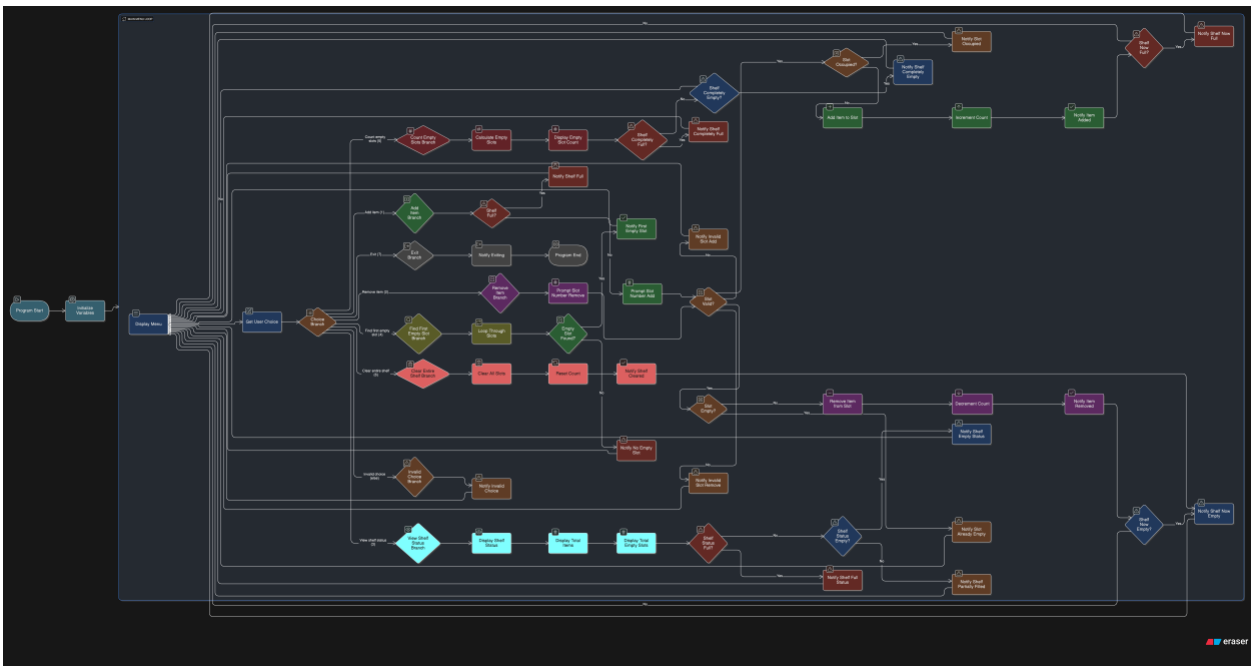
The system must satisfy the following user requirements:

1. **Add Item:** Mark a specific, currently empty slot as occupied, provided the shelf is not full.
2. **Remove Item:** Mark a specific, currently occupied slot as empty.
3. **View Status:** Display the occupancy status (Empty/Occupied) for every slot, along with an overall summary (total items, total empty slots).
4. **Find Empty Slot:** Identify and report the index of the first available empty slot, starting from index 0.
5. **Count Empty Slots:** Calculate and display the total number of empty slots remaining.
6. **Clear Shelf:** Reset the status of all slots to empty.
7. **Exit:** Terminate the application gracefully.

2.3. Constraints

- **Fixed Capacity:** The shelf must have a fixed capacity, defined by MAX_SLOTS (currently 10).
- **Binary State:** Each slot can only exist in one of two states: occupied or empty (1 or 0).
- **Data Structure:** The storage mechanism must be a standard C array.
- **User Interface:** The interface must be command-line (console) based.

SYSTEM DESIGN



Algorithm: Warehouse Shelf Tracker

Global Definitions

- **Define Constant MAX_SLOTS = 10**
  Represents the total number of shelf slots available.
- **Define Array shelf[MAX_SLOTS]**
  Stores 0 (empty) or 1 (occupied) for each slot.
- **Define Integer count = 0**
  Stores the number of occupied slots.

Main Function (Control Loop)

Step 1: Start.

Step 2: Initialize variables

- Declare integer choice.
- Declare integer slot.
- Initialize array shelf with 0 (empty).

Step 3 (Start of Loop): Display the Main Menu:

1. Add item to a slot
2. Remove item from a slot
3. View shelf status
4. Find first empty slot
5. Count empty slots
6. Clear entire shelf
7. Exit

Step 4: Ask user to enter choice. Read input into choice.

Step 5: Check user choice using Switch Case.

Case 1: Add Item

1. Check if count == MAX_SLOTS
    - If TRUE: Display "Shelf Full" and Return.
2. Ask user for slot number.
3. Validate slot number (0–9).
4. Check if slot is already occupied.

5. If empty:
    - Set shelf[slot] = 1
    - Increment count
    - Display success message
6. If count becomes 10, display "Shelf Full Warning".
7. Return to Main Menu.

Case 2: Remove Item

1. Ask user for slot number.
2. Validate slot number (0–9).
3. Check if slot is already empty:
    - If TRUE: Display "Already Empty".
4. Else:
    - Set shelf[slot] = 0
    - Decrement count
    - Display "Item Removed".
5. If count becomes 0, display "Shelf Empty".
6. Return to Main Menu.

Case 3: View Shelf Status

1. Print table-like slot status for all slots.
2. Display total items stored.
3. Display total empty slots.
4. Display Shelf Status:
    - FULL (if count == 10)
    - EMPTY (if count == 0)
    - PARTIALLY FILLED otherwise
5. Return.

Case 4: Find First Empty Slot

1. Loop from i = 0 to 9
2. If shelf[i] == 0:
    - Display that slot i is the first empty
    - Break
3. If no slot found, display "Shelf Full".
4. Return.

Case 5: Count Empty Slots

1. Compute empty = MAX_SLOTS - count.
2. Display number of empty slots.

3. If empty == 0, display "Shelf Full".
4. If empty == 10, display "Shelf Empty".
5. Return.

Case 6: Clear Entire Shelf

1. Loop from i = 0 to 9:
    - Set shelf[i] = 0
2. Set count = 0
3. Display "All slots cleared".
4. Return.

Case 7: Exit

1. Display “Exiting Program…”
2. Stop the program.

Default Case

1. Display “Invalid Choice”.
2. Return to Main Menu.

IMPLEMENTATION DETAILS

1. Initializing Shelf System

A static integer array shelf[MAX_SLOTS] is used to store the status of 10 shelf slots, where
0 = empty and 1 = occupied.
A counter variable count tracks the total number of occupied slots.
Implemented using: arrays and variable initialization.

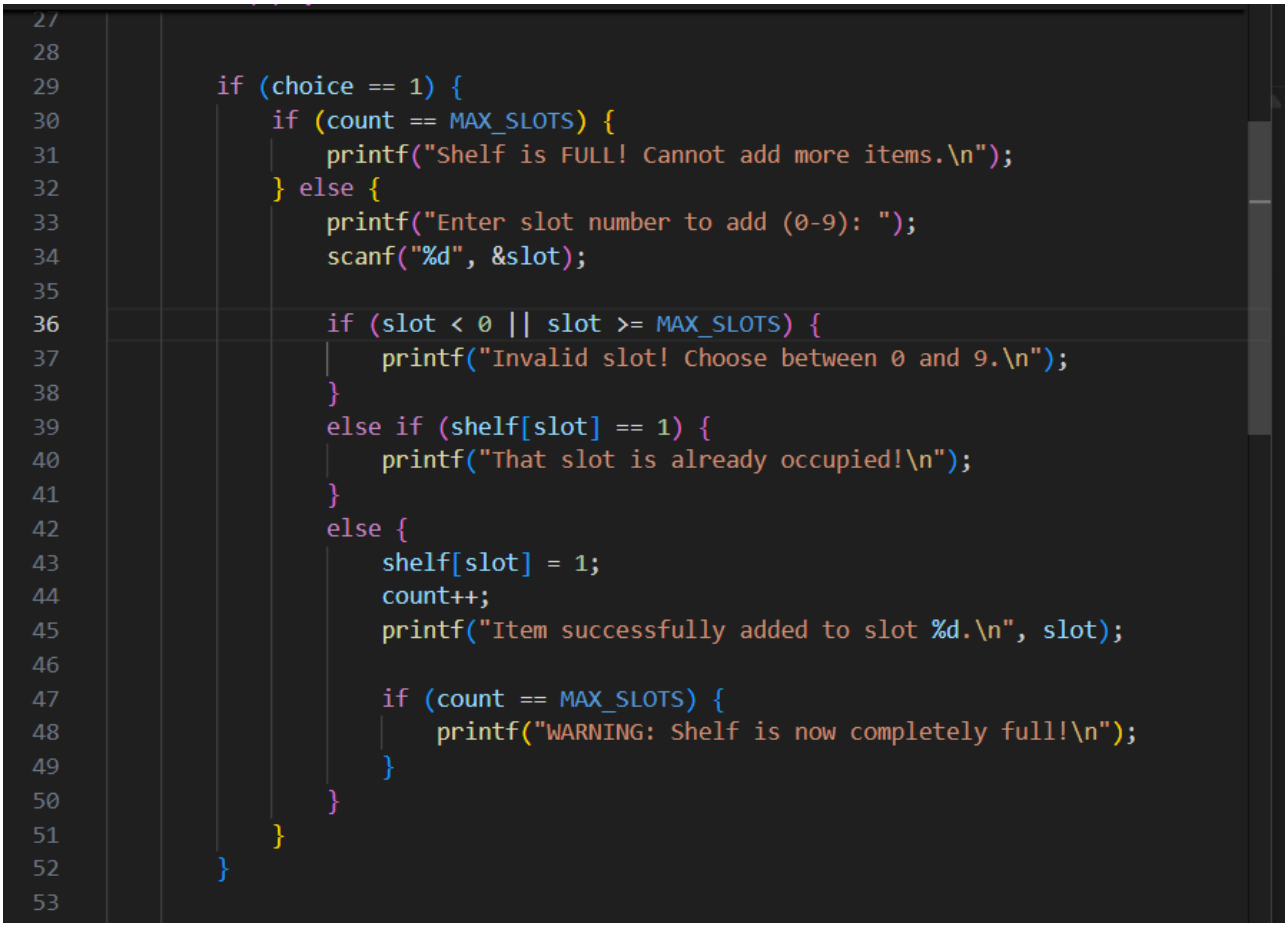
---

2. Adding an Item

The user enters a slot number.
The program checks if:

- the slot number is between 1–10
- the selected slot is empty

If valid, the program marks the slot as occupied and increments the count.
Implemented using: array indexing, validation, and conditionals.



```
27
28
29          if (choice == 1) {
30              if (count == MAX_SLOTS) {
31                  printf("Shelf is FULL! Cannot add more items.\n");
32              } else {
33                  printf("Enter slot number to add (0-9): ");
34                  scanf("%d", &slot);
35
36                  if (slot < 0 || slot >= MAX_SLOTS) {
37                      printf("Invalid slot! Choose between 0 and 9.\n");
38                  }
39                  else if (shelf[slot] == 1) {
40                      printf("That slot is already occupied!\n");
41                  }
42                  else {
43                      shelf[slot] = 1;
44                      count++;
45                      printf("Item successfully added to slot %d.\n", slot);
46
47                      if (count == MAX_SLOTS) {
48                          printf("WARNING: Shelf is now completely full!\n");
49                      }
50                  }
51              }
52          }
53
```

---

3. Removing an Item

The user chooses a slot to clear.
The program checks if:

- the slot number is valid
- the slot contains an item

If true, the slot is set to empty and the count decreases.
Implemented using: conditional checks and array updates.

```
    else if (choice == 2) {
        printf("Enter slot number to remove (0-9): ");
        scanf("%d", &slot);

        if (slot < 0 || slot >= MAX_SLOTS) {
            printf("Invalid slot! Choose between 0 and 9.\n");
        }
        else if (shelf[slot] == 0) {
            printf("Slot %d is already empty!\n", slot);
        }
        else {
            shelf[slot] = 0;
            count--;
            printf("Item removed from slot %d.\n", slot);

            if (count == 0) {
                printf("Shelf is now completely empty.\n");
            }
        }
    }

```

---

4. Viewing Shelf Status

Displays all 10 slots with their status (Empty/Occupied).
Loop is used to iterate through the array and print values.
Implemented using: for loops and formatted output.

```

    else if (choice == 3) {
        printf("Current Shelf Status:\n");
        printf("----------------------------\n");

        for (i = 0; i < MAX_SLOTS; i++) {
            if (shelf[i] == 1)
                printf("Slot %d : Occupied\n", i);
            else
                printf("Slot %d : Empty\n", i);
        }

        printf("----------------------------\n");
        printf("Total items stored: %d\n", count);
        printf("Total empty slots: %d\n", MAX_SLOTS - count);

        if (count == MAX_SLOTS)
            printf("SHELF STATUS: FULL\n");
        else if (count == 0)
            printf("SHELF STATUS: EMPTY\n");
        else
            printf("SHELF STATUS: PARTIALLY FILLED\n");
    }

```

---

5. Viewing Total Items

Simply prints the value of the counter variable count, which stores the number of occupied slots.
Implemented using: integer counter tracking.

```
100         else if (choice == 4) {
101             int found = 0;
102 
103             for (i = 0; i < MAX_SLOTS; i++) {
104                 if (shelf[i] == 0) {
105                     printf("First empty slot is: %d\n", i);
106                     found = 1;
107                     break;
108                 }
109             }
110 
111             if (!found)
112                 printf("No empty slot found. Shelf is full!\n");
113         }
114 
```

---

6. Resetting All Slots

This option clears all shelf slots by setting the entire array back to zero and resetting count to 0.
Implemented using: loops to reset array values.

```
114
115
116         else if (choice == 5) {
117             int empty = MAX_SLOTS - count;
118
119             printf("Total empty slots: %d\n", empty);
120
121             if (empty == 0)
122                 printf("Shelf is completely full.\n");
123             else if (empty == MAX_SLOTS)
124                 printf("Shelf is completely empty.\n");
125         }
126
127
128         else if (choice == 6) {
129             for (i = 0; i < MAX_SLOTS; i++)
130                 shelf[i] = 0;
131
132             count = 0;
133
134             printf("All slots have been cleared.\n");
135             printf("Shelf is now completely empty.\n");
136         }
137
```

---

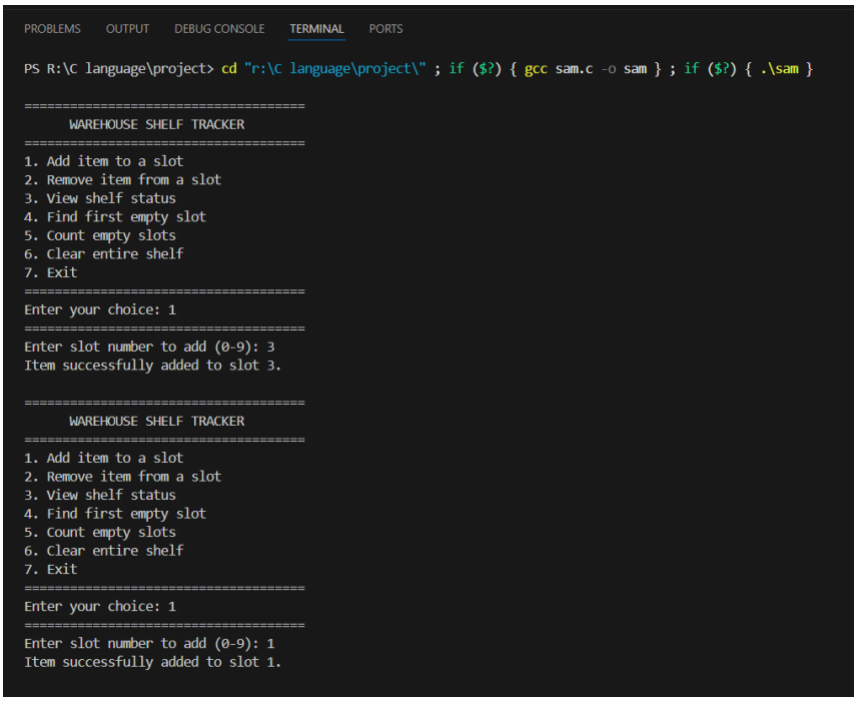
7. Exiting the Program

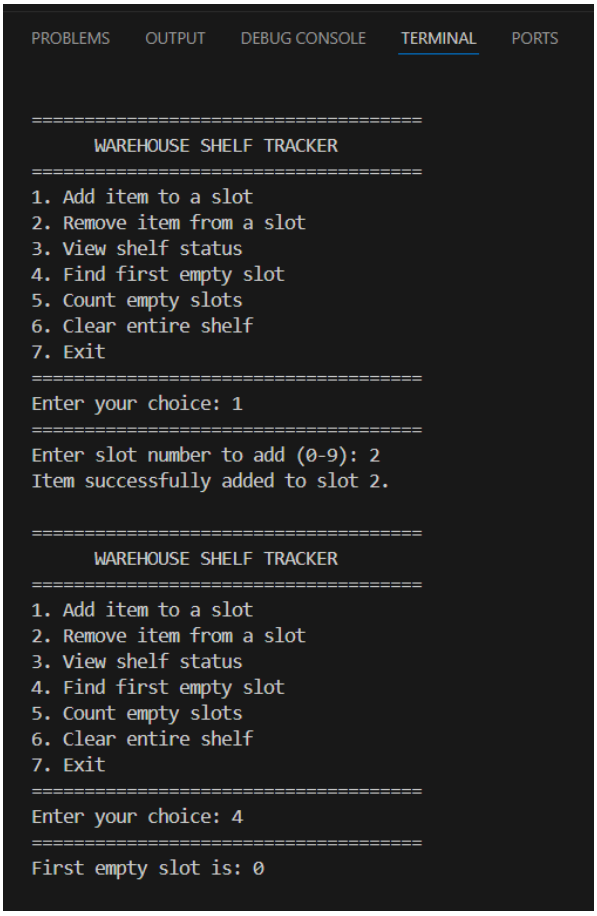
Selecting this option terminates the infinite loop and exits the program.
Implemented using: return statement from main().

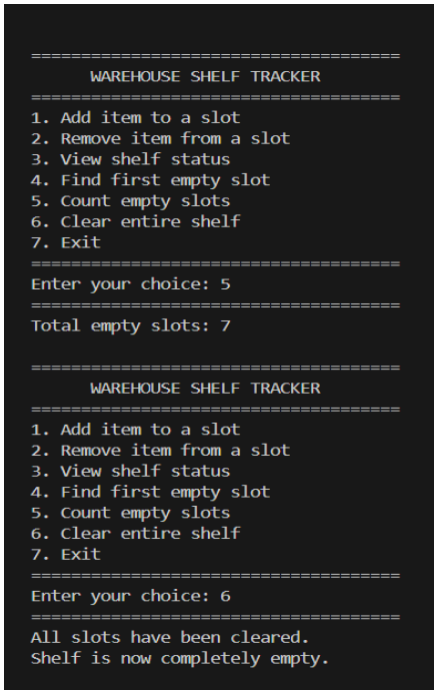
```
138         else if (choice == 7) {
139             printf("Exiting program... Goodbye!\n");
140             break;
141         }
142
143         else {
144             printf("Invalid choice! Please select a valid option.\n");
145         }
146     }
147
148     return 0;
149 }
150
```

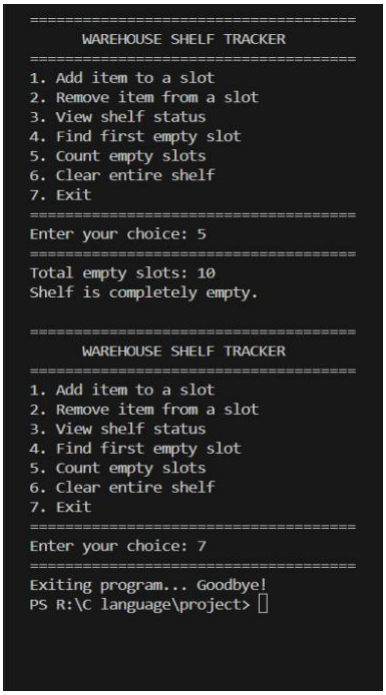
Testing and Results

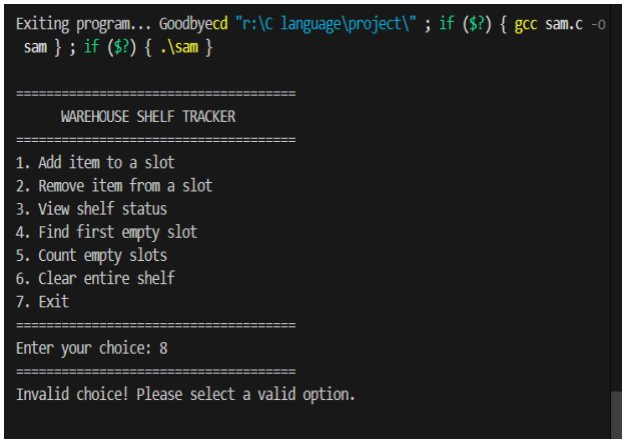
The code was tested through various scenarios, inputting both valid and invalid entries.











CONCLUSION & FUTURE WORK

Conclusion

The *Warehouse Shelf Tracker* successfully demonstrates how arrays and menu-driven programming can be used to manage storage slots efficiently. The program allows users to add, remove, search, count, and clear shelf items in real time. It ensures error-free operation through proper input validation and provides clear system status updates. This project strengthens understanding of conditional logic, loops, array manipulation, and user-interactive C applications.

Future Work

To improve and expand this project, the following enhancements can be implemented:

1. Dynamic Shelf Size

Allow users to choose the number of slots instead of using a fixed size (10).

2. Item Details

Store more information about each item (name, ID, weight, category) instead of only 0 and 1.

3. File Handling

Save shelf data to a file and load it on program start, ensuring data is not lost when the program exits.

4. Search Feature

Add functionality to search for specific items or item types.

5. GUI Version

Upgrade the program from a console interface to a graphical interface using libraries like GTK or a simple web-based frontend.

6. Multiple Shelves / Sections

Extend support for multiple racks, shelves, or warehouse zones.

7. Automatic Slot Allocation

Introduce algorithms to automatically find optimal slots based on size, weight, or item type.

8. Error Logging

Add logs to track incorrect inputs, removals, or system warnings.

REFERENCES

1. Mr. Rahul Prasad

2. Let us C by Yashwant Kanetkar

3. https://www.programiz.com/c-programming/online-compiler/

4. https://www.geeksforgeeks.org/c/c-programming-language/

APPENDIX

SOURCE CODE

```
#include <stdio.h>

#define MAX_SLOTS 10

int main() {

    int shelf[MAX_SLOTS] = {0};
    int choice, slot;
    int count = 0;
    int i;

    while (1) {
        printf("\n====================================\n");
        printf("      WAREHOUSE SHELF TRACKER\n");
        printf("====================================\n");
        printf("1. Add item to a slot\n");
        printf("2. Remove item from a slot\n");
        printf("3. View shelf status\n");
        printf("4. Find first empty slot\n");
```

```
printf("5. Count empty slots\n");
printf("6. Clear entire shelf\n");
printf("7. Exit\n");
printf("====================================\n");
printf("Enter your choice: ");
scanf("%d", &choice);
printf("====================================\n");

if (choice == 1) {
   if (count == MAX_SLOTS) {
      printf("Shelf is FULL! Cannot add more items.\n");
   } else {
      printf("Enter slot number to add (0-9): ");
      scanf("%d", &slot);

      if (slot < 0 || slot >= MAX_SLOTS) {
         printf("Invalid slot! Choose between 0 and 9.\n");
      }
      else if (shelf[slot] == 1) {
         printf("That slot is already occupied!\n");
      }
      else {
         shelf[slot] = 1;
         count++;
         printf("Item successfully added to slot %d.\n", slot);
```

```
            if (count == MAX_SLOTS) {
                printf("WARNING: Shelf is now completely full!\n");
            }
        }
    }
}

else if (choice == 2) {
    printf("Enter slot number to remove (0-9): ");
    scanf("%d", &slot);

    if (slot < 0 || slot >= MAX_SLOTS) {
        printf("Invalid slot! Choose between 0 and 9.\n");
    }
    else if (shelf[slot] == 0) {
        printf("Slot %d is already empty!\n", slot);
    }
    else {
        shelf[slot] = 0;
        count--;
        printf("Item removed from slot %d.\n", slot);

        if (count == 0) {
            printf("Shelf is now completely empty.\n");
        }
    }
```

```
}

else if (choice == 3) {
   printf("Current Shelf Status:\n");
   printf("----------------------------\n");

   for (i = 0; i < MAX_SLOTS; i++) {
      if (shelf[i] == 1)
         printf("Slot %d : Occupied\n", i);
      else
         printf("Slot %d : Empty\n", i);
   }

   printf("----------------------------\n");
   printf("Total items stored: %d\n", count);
   printf("Total empty slots: %d\n", MAX_SLOTS - count);

   if (count == MAX_SLOTS)
      printf("SHELF STATUS: FULL\n");
   else if (count == 0)
      printf("SHELF STATUS: EMPTY\n");
   else
      printf("SHELF STATUS: PARTIALLY FILLED\n");
}

else if (choice == 4) {
```

```
    int found = 0;

    for (i = 0; i < MAX_SLOTS; i++) {
        if (shelf[i] == 0) {
            printf("First empty slot is: %d\n", i);
            found = 1;
            break;
        }
    }

    if (!found)
        printf("No empty slot found. Shelf is full!\n");
}

else if (choice == 5) {
    int empty = MAX_SLOTS - count;

    printf("Total empty slots: %d\n", empty);

    if (empty == 0)
        printf("Shelf is completely full.\n");
    else if (empty == MAX_SLOTS)
        printf("Shelf is completely empty.\n");
}

else if (choice == 6) {
```

```
            for (i = 0; i < MAX_SLOTS; i++)
                shelf[i] = 0;

            count = 0;

            printf("All slots have been cleared.\n");
            printf("Shelf is now completely empty.\n");
        }

        else if (choice == 7) {
            printf("Exiting program... Goodbye!\n");
            break;
        }

        else {
            printf("Invalid choice! Please select a valid option.\n");
        }
    }

    return 0;
}
```