Task 1B: Bit Operations using Operators and Control Structures

Objective:
To understand bitwise operations in C by implementing functions to:
- Count number of set bits
- Get a specific bit
- Set a specific bit
- Toggle a specific bit

Using different control structures.

1. C Program Used

Below is the C program written for this task.
A screenshot of the code editor showing the complete program.

Screenshot :

GNU nano 6.2

```c
#include <stdio.h>

/* Count set bits using while loop */
int countBits_while(int n) {
    int count = 0;
    while (n) {
        count += n & 1;
        n >>= 1;
    }
    return count;
}

/* Count set bits using for loop */
int countBits_for(int n) {
    int count = 0;
    for (; n; n >>= 1) {
        count += n & 1;
    }
    return count;
}

/* Get specific bit (0 or 1) */
int getBit(int n, int pos) {
    return (n >> pos) & 1;
}

/* Set a specific bit */
int setBit(int n, int pos) {
    return n | (1 << pos);
}

/* Toggle a specific bit */
int toggleBit(int n, int pos) {
    return n ^ (1 << pos);
```

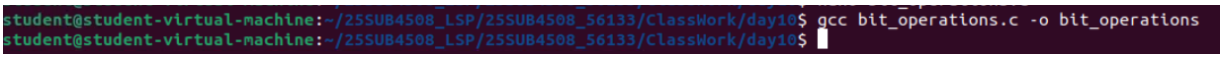
```c
}

int main() {
    int num = 10;    // Binary: 1010
    int pos = 1;

    printf("Number: %d\n", num);
    printf("Count bits (while): %d\n", countBits_while(num));
    printf("Count bits (for): %d\n", countBits_for(num));
    printf("Bit at position %d: %d\n", pos, getBit(num, pos));
    printf("After setting bit %d: %d\n", pos, setBit(num, pos));
    printf("After toggling bit %d: %d\n", pos, toggleBit(num, pos));

    return 0;
}
```

2. Compilation

Compile the program using gcc.

Command:
gcc bit_operations.c -o bit_operations

Screenshot :

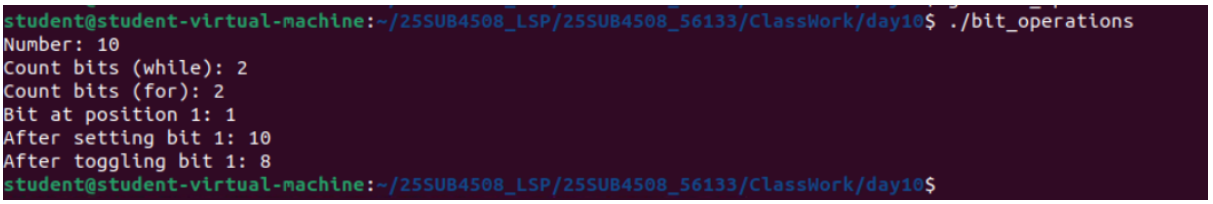


3. Program Execution

Run the compiled program.

Command:
./bit_operations

Screenshot :



4. Explanation of Functions

Functions implemented:

1. countBits_while() – Uses while loop
2. countBits_for() – Uses for loop
3. getBit() – Gets value of specific bit
4. setBit() – Sets a bit to 1
5. toggleBit() – Toggles bit value

5. Conclusion

This task demonstrates how bitwise operators work internally and how different control structures can be used to solve the same problem.