Bitwise operators Assignment

Q1. WAP to read a 8 bit unsigned integer, interchange the adjacent bits i.e D0 with D1, D2 with D3..... D6 with D7. Display the final number.

Input: 0xAA

Output: 0x55

Sol:

```
#include <stdio.h>

int main() {
   unsigned char num;
   printf("Enter an 8-bit unsigned integer in hex (e.g., 0xAA): ");
   scanf("%hhx", &num);
   unsigned char even_bits = num & 0x55;  // Extract D0, D2, D4, D6
   unsigned char odd_bits = num & 0xAA;   // Extract D1, D3, D5, D7

  // Shift the even bits left and odd bits right
   even_bits = even_bits << 1;  // Shift even bits left by 1
   odd_bits = odd_bits >> 1;    // Shift odd bits right by 1

   // Combine the shifted bits
   unsigned char result = even_bits | odd_bits;
   printf("Output after swapping adjacent bits: 0x%02X\n", result);

   return 0;
}
```

Output:

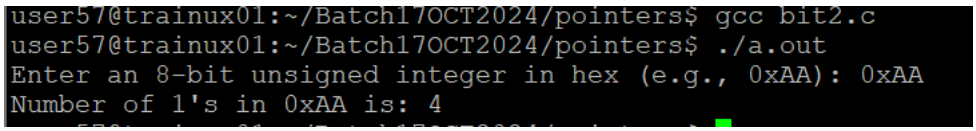
```
user57@trainux01:~/Batch17OCT2024/pointers$ vi bit1.c
user57@trainux01:~/Batch17OCT2024/pointers$ gcc bit1.c
user57@trainux01:~/Batch17OCT2024/pointers$ ./a.out
Enter an 8-bit unsigned integer in hex (e.g., 0xAA): 0xAA
Output after swapping adjacent bits: 0x55
```

Q2. WAP to count the number of 1's in a given byte and display

Sol:

```
#include <stdio.h>


int count_ones(unsigned char num) {
   int count = 0;
   while (num) {
      // Remove the rightmost 1 bit
      num = num & (num - 1);
      count++;
   }
   return count;
}
int main() {
   unsigned char num;


   printf("Enter an 8-bit unsigned integer in hex (e.g., 0xAA): ");
   scanf("%hhx", &num);


   // Call the function to count 1's in the byte
   int ones_count = count_ones(num);
   printf("Number of 1's in 0x%02X is: %d\n", num, ones_count);


   return 0;
}
```

Output:



Q3. Generate odd and even parity bits for a given number. (consider a 32 bit number)

[Hint: You may reuse the solution created in Q2 and extend it further.

Sol:

```
#include <stdio.h>
int count_ones(unsigned int num) {
   int count = 0;
   while (num) {
      // Remove the rightmost 1 bit
      num = num & (num - 1);
      count++;
   }
   return count;
}
void generate_parity(unsigned int num) {
   int ones_count = count_ones(num);

   int even_parity = (ones_count % 2 == 0) ? 0 : 1;  // Even parity bit is 0 if count is even, else 1
   int odd_parity = (ones_count % 2 == 0) ? 1 : 0;   // Odd parity bit is 1 if count is even, else 0

   printf("For the 32-bit number 0x%08X:\n", num);
   printf("Even Parity Bit: %d\n", even_parity);
   printf("Odd Parity Bit: %d\n", odd_parity);
}
int main() {
   unsigned int num;
   printf("Enter a 32-bit unsigned integer in hex (e.g., 0xAA): ");
   scanf("%x", &num);
   generate_parity(num);

   return 0;
}
```

Output:

```
Enter a 32-bit unsigned integer in hex (e.g., 0xAA): 0x123456789
For the 32-bit number 0x23456789:
Even Parity Bit: 0
Odd Parity Bit: 1
user57@trainux01:~/Batch17OCT2024/pointers$ ./a.out
Enter a 32-bit unsigned integer in hex (e.g., 0xAA): 0x000000FF
For the 32-bit number 0x000000FF:
Even Parity Bit: 0
Odd Parity Bit: 1
```

Q4. WAP to reverse the bytes in a 32 but unsigned integer using shift operator.

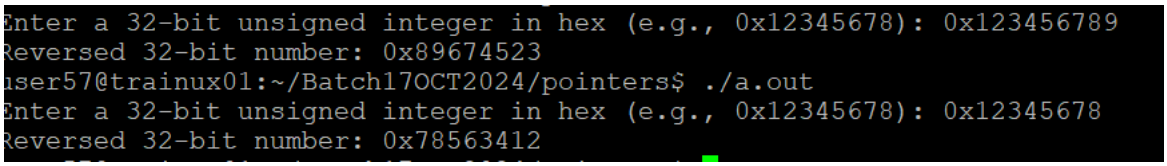
Input: 0x12345678

Output: 0x78563412

Sol:

```
#include <stdio.h>
unsigned int reverse_bytes(unsigned int num) {
   unsigned int byte1, byte2, byte3, byte4;
 // Extract each byte using shift and mask
   byte1 = (num & 0xFF) << 24;  // Get the LSB and shift it to the MSB position
   byte2 = (num & 0xFF00) << 8; // Get the second byte and shift it
   byte3 = (num & 0xFF0000) >> 8; // Get the third byte and shift it
   byte4 = (num & 0xFF000000) >> 24; // Get the MSB and shift it

   return byte1 | byte2 | byte3 | byte4;
}

int main() {
   unsigned int num;
   printf("Enter a 32-bit unsigned integer in hex (e.g., 0x12345678): ");
   scanf("%x", &num);

   unsigned int reversed_num = reverse_bytes(num);
   printf("Reversed 32-bit number: 0x%08X\n", reversed_num);
   return 0;
}
```

Output:



Q2. WAP to count the number of 1's in a given byte and display

Q3. Generate odd and even parity bits for a given number. (consider a 32 bit number)

[Hint: You may reuse the solution created in Q2 and extend it further]

Q4. WAP to reverse the bytes in a 32 but unsigned integer using shift operator.

Input: 0x12345678

Output: 0x78563412