Department of
Computer Science and Engineering

Title: IPv4 implementation of Decimal to Binary and vice versa

Data Communication Lab

CSE 308

Green University of Bangladesh

1 Objective(s)

- To convert decimal (dotted decimal ip) to binary (32 bit ip) and vice-versa manually by creating a user-defined function.

2 Problem analysis

2.1 Decimal to Binary

To convert numbers from decimal to binary, the given decimal number is divided repeatedly by 2 and the remainders are noted down till we get 0 as the final quotient. The following steps is considered as the decimal to binary formula that shows the procedure of conversion.
Step 1: Divide the given decimal number by 2 and note down the remainder.
Step 2: Now, divide the obtained quotient by 2, and note the remainder again.
Step 3: Repeat the above steps until you get 0 as the quotient.
Step 4: Now, write the remainders in such a way that the last remainder is written first, followed by the rest in the reverse order.
Step 5: This can also be understood in another way which states that the Least Significant Bit (LSB) of the binary number is at the top and the Most Significant Bit (MSB) is at the bottom. This number is the binary value of the given decimal number.
Let us understand this with an example.
Example: Convert the decimal number 1310 to binary.
Solution: We will start dividing the given number (13) repeatedly by 2 until we get the quotient as 0. We will note the remainders in order.

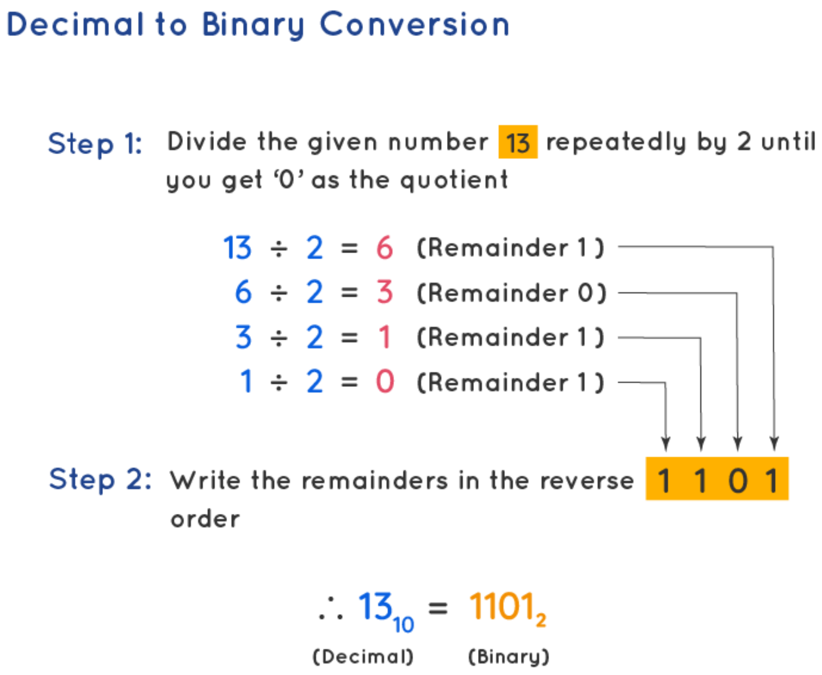
Decimal to Binary Conversion
Step 1: Divide the given number 13 repeatedly by 2 until you get '0' as the quotient
13 ÷ 2 = 6 (Remainder 1)
6 ÷ 2 = 3 (Remainder 0)
3 ÷ 2 = 1 (Remainder 1)
1 ÷ 2 = 0 (Remainder 1)
Step 2: Write the remainders in the reverse order
1 1 0 1
∴ 13₁₀ = 1101₂
(Decimal)
(Binary)

Figure 1: Decimal to Binary Conversion

2.2 Binary to Decimal

The positional notation method is one in which the value of a digit in a number is determined by a weight based on its position. This is achieved by multiplying each digit by the base(2) raised to the respective power depending upon the position of that digit in the number. The summation of all these values obtained for each digit gives the equivalent value of the given binary number in the decimal system.

Observe the following steps to understand the binary to decimal conversion. Let us consider the binary number (101101)2. In any binary number, the rightmost digit is called the 'Least Significant Bit' (LSB) and the left-most digit is called the 'Most Significant Bit' (MSB). For a binary number with 'n' digits, the least significant bit has a weight of 20 and the most significant bit has a weight of 2n-1.

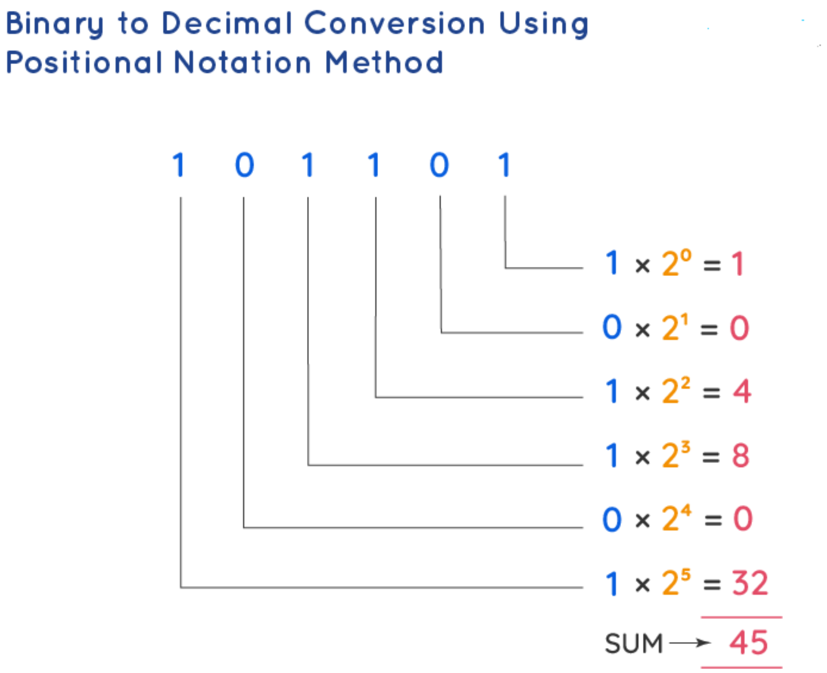

Figure 2: Binary to Decimal Conversion

3 Code Implementation in C (Decimal to Binary)

```c
// convert decimal to binary

#include <stdio.h>
#include <math.h>

int convert(int);

int main() {
  int n, bin;
  printf("Enter a decimal number: ");
  scanf("%d", &n);
  bin = convert(n);
  printf("%d in binary =  %d ", n, bin);
  return 0;
}

int convert(int n) {
  int bin = 0;
  int rem, i = 1;

  while (n!=0) {
    rem = n % 2;
    n /= 2;
    bin += rem * i;
    i *= 10;
  }

  return bin;
  }
```

4 Sample Input/Output (Compilation, Debugging & Testing)

Enter a decimal number: 13
13 in binary: 1101

5 Code Implementation in C (Binary to Decimal)

```
// convert binary to decimal

#include <stdio.h>
#include <math.h>

// function prototype
int convert(long long);

int main() {
  long long n;
  printf("Enter a binary number: ");
  scanf("%lld", &n);
  printf("%lld in decimal : %d", n, convert(n));
  return 0;
}

// function definition
int convert(long long n) {
  int dec = 0, i = 0, rem;

  while (n!=0) {
    rem = n % 10;
    n /= 10;
    dec += rem * pow(2, i);
    ++i;
  }

  return dec;
}
```

6 Sample Input/Output (Compilation, Debugging & Testing)

Enter a binary number: 1101
1101 in decimal: 13

7 Discussion & Conclusion

Based on the focused objective(s) to understand about the algorithms, the additional lab exercise made me more confident towards the fulfilment of the objectives(s).

8 Lab Task (Please implement yourself and show the output to the instructor)

1. Convert an ipv4 dotted decimal ip to 32-bit binary ip.

9 Lab Exercise (Submit as a report)

- Convert an ipv4 32-bit binary ip to dotted decimal ip.

10 References

1. https://www.cuemath.com/numbers/decimal-to-binary/
2. https://www.cuemath.com/numbers/binary-to-decimal/
3. https://www.programiz.com/c-programming/examples/binary-decimal-convert

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