

EE103 – INTRODUCTION TO PROGRAMMING – LAB 6

String Operations and Number Bases

Hexadecimal Numbers

The standard numeral system which is called decimal uses base 10 numbering system and it has 10 symbols to represent its digits (0 - 9). Hexadecimal numbering system uses base 16 system which uses 16 different digits (0 - 15) to represent numbers. The digits between from 10 to 15 need two symbols in standard numeral system. Because of that Hexadecimal needs extra six symbol to represent these digits. There are no numerical symbols that represent values greater than nine, so some letters from the English alphabet are used to solve that problem.

'A' = 10 'B' = 11 'C' = 12 'D' = 13 'E' = 14 'F' = 15

Hexadecimal to Decimal Conversion

$$(ABCD)_n = A.n^3 + B.n^2 + C.n^1 + D.n^0 \text{ (General formula)}$$

$$\text{Example: } (1A9D)_{16} = 1*16^3 + 10*16^2 + 9*16^1 + 13*16^0 = (6813)_{10}$$

Binary Numbers

Binary numbers uses base 2 system so it has two digits. This system needs two symbols which are 0 and 1.

Decimal to Binary Conversion

Example:

$$(57)_{10} = (111001)_2$$

| | | |
|---------------|-----------------------|---------------|
| $57 \% 2 = 1$ | $57 - (57 \% 2) = 56$ | $56 / 2 = 28$ |
| $28 \% 2 = 0$ | $28 - (28 \% 2) = 28$ | $28 / 2 = 14$ |
| $14 \% 2 = 0$ | $14 - (14 \% 2) = 14$ | $14 / 2 = 7$ |
| $7 \% 2 = 1$ | $7 - (7 \% 2) = 6$ | $6 / 2 = 3$ |
| $3 \% 2 = 1$ | $3 - (3 \% 2) = 2$ | $2 / 2 = 1$ |
| $1 \% 2 = 1$ | $1 - (1 \% 2) = 0$ | $0 / 2 = 0$ |

Writing the numbers which are the result of the modulus operation, backwards gives us the binary representation of the decimal number!

Q) Write a C code that can convert a hexadecimal number to binary number in the main function.

- Take a hexadecimal number from the user. [20p]
 - Because of the hexadecimal symbols, these numbers must store in a string or char array.
- Convert the hexadecimal number to a decimal number and print the result. [40p]
 - You may use itoa() or atoi() functions in the "string.h" library

- Convert the decimal number to a binary number, store binary number in a string or char array and print the result. [40p]
 - You need to follow the algorithm which is given in decimal to binary conversion. You may use itoa() and atoi() functions to realize this conversion but you can't get full points. (15p)
- Output of the system must be example given below.

```
Enter a hexadecimal number
FD
hexLength = 2

Given Hex number = FD
Decimal equivalent = 253
Binary equivalent = 11111101
Process returned 0 (0x0)   execution time : 4.355 s
Press any key to continue.
```

```
Enter a hexadecimal number
1A9D
hexLength = 4

Given Hex number = 1A9D
Decimal equivalent = 6813
Binary equivalent = 1101010011101
Process returned 0 (0x0)   execution time : 21.452 s
Press any key to continue.
```

You can use this link to access [ASCII TABLE](#)

You can use this link to access [C file](#) which has been shared in M. Teams

| Dec | Hex | Oct | Binary | Char |
|-----|-----|-----|---------|------|
| 48 | 30 | 060 | 0110000 | 0 |
| 49 | 31 | 061 | 0110001 | 1 |
| 50 | 32 | 062 | 0110010 | 2 |
| 51 | 33 | 063 | 0110011 | 3 |
| 52 | 34 | 064 | 0110100 | 4 |
| 53 | 35 | 065 | 0110101 | 5 |
| 54 | 36 | 066 | 0110110 | 6 |
| 55 | 37 | 067 | 0110111 | 7 |
| 56 | 38 | 070 | 0111000 | 8 |
| 57 | 39 | 071 | 0111001 | 9 |
| 58 | 3A | 072 | 0111010 | : |