

CS150-01 Lab 5

Binary Numbers

Date Assigned: Tuesday, September 27, 2005

Date Due: Thursday, September 29, 2009

Points: 15

Objectives

The main objective of this assignment is to use arithmetic operators to solve a complex problem.

Problem statement

You had so much fun at the last family reunion teaching the younger members of your extended family how to calculate family members' ages based on their year of birth, and now that you've started your computer science course and learnt more about computers, you have decided to teach the young kids about the binary number system. To help you teach them the concepts, you have decided to write a program that will convert a decimal number to its binary equivalent.

You have decided to write a C++ program that allows the user the ability to input from the keyboard an integer in the range of 0 to 255. This number represents a decimal value. As output, you will print the decimal number followed by the equivalent binary value of this number.

If the number entered is between 0 and 15, the output will use 4 bits, but if the number is between 16 and 255, you will use 8 bits. If the number is outside of the range 0 - 255, you will output an error message.

For your information, the following table represents the numbers 0 - 15:

Decimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

Sample output

```
*****  
THE NUMBER CONVERTER  
*****  
Enter a decimal number between 0 and 255: 10  
The decimal 10 is binary 1010  
Press any key to continue
```

Another output example:

```
*****  
THE NUMBER CONVERTER  
*****  
Enter a decimal number between 0 and 255: 36  
The decimal 36 is binary 0010 0100  
Press any key to continue
```

Steps for software development

1. First, we need to understand the program requirements. What needs to be calculated? Is there any additional information that we need?
2. Next, we need a program analysis. Answering the following questions will help guide you through the process.
 - (a) What is the input to your program? What units will it be in?
 - (b) What is the output to your program? What units will it be in?
 - (c) Is there any data that will be internal to your program?
 - (d) What are the calculations needed for your program? Here you need to think about the procedure of converting from one number system (i.e. decimal) to another number system (i.e. binary). How do we get from 10 (decimal) to 1010 (binary)?

3. What is the algorithm to solve this problem? Here you should describe in English the steps for solving the program.

4. Create a new project in Visual Studio .NET. You should name your project "05binaryPuNet", where PUNetId is your own id. I would name my project "05binarykhoj0332". While working on a project, it should be located on the current computer you are working on (i.e. the desktop). Once you have completed developing, you should copy the project folder onto Turing.
5. Write the code that will solve the problem. Make sure that you add comments to the code as you type.
6. How can you verify that your program works correctly? What numbers would you use to test the program.

Optional extension

Once you have completed all of the above, have a go at trying to expand the capabilities of your program.

The program you have just written is converting numbers from base 10 (decimal) to base 2 (binary). Modify the above program to convert a base 10 number to any base between 2 and 9 inclusive.

What to turn in

When you have completed writing the program and you have verified that it works correctly, you will need to show it to the instructor or the TA.

Once you have done this you will submit the project for grading. You submit your program by placing a copy of the project folder in the "CS150-01 Lab" folder on Turing. Make sure that you also place a copy of the project folder in your own folder on Turing.