Faculty of Engineering and Applied Science

SOFE 2850U Natural Foundations of Information Technology

Assignment 1

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Assignment 1 Question 1: Problem Solving Strategy

The programming task requires the development of a numbering system calculator to convert any number from any base to any other base. The bases used within the context of this application are base 2, 8, 10 and 16. Base 16 specifically presents a unique challenge since it uses an alpha-numeric numbering system including both, the numbers from 0 to 9 as well as letters A through to F.

High-Level Approach

This problem is solve using three (3) main steps:

1. Validate user input
2. Convert input from the source base to decimal
3. Convert from decimal to the target base

To avoid hard-coding individual conversions between each combination of bases, The user provided input is first converted to decimal and then converted to its target base. This allows for two primary functions to be used in tandem to perform all conversions regardless of the source and target bases. This approach is illustrated below in *Figure 1*:

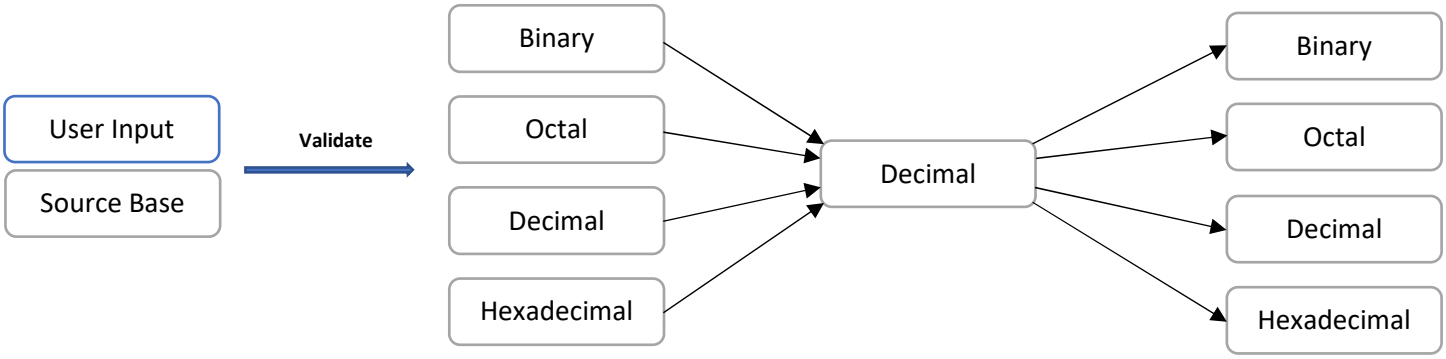

Figure 1: High-level overview of the problem-solving process to convert from the source base to a target base in the numbering systems of Base 2, 8, 10 and 16.

Base Conversion

Base conversion from the source base to decimal is done through a generic weighted multiplication, where each digit is multiplied a power of the source base based on the position of the digit within the number and then adding the outcome of each multiplication together. The least significant digit will be multiplied by the source base raised to the power 0 and the most significant digit will be multiplied by the source base raised to the power of n – 1, where n is the number of digits.

Similarly, base conversion from decimal to the target base is done through the successive division method, where the base to divide by is provided as a parameter. This allows one function to act generically upon any target base.

Conclusion

This approach has demonstrated how base conversions between different numbering systems can be done generically. This strategy is very flexible and can be adapted to any other base in the future through only minor modifications to the source code.