CM 1015 Computational Mathematics

Kevin Juandi
email: kjuandi@gmail.com

April 20, 2023

Preface

I wrote this note after finishing the course, so the content might not reflect the current version of the course. It is mostly based on my handwritten personal notes. I personally feel this course should be called "Foundation Mathematics" instead of "Computational Mathematics" because of the lack of "Numerical Methods" and probably some other things people more familiar with the topic would say. If you spot any error please don't hesitate to contact me via slack or mail me. I will update the notes along with the pace of the course, every Saturday or Sunday before the start of the week. If you need help with the subject, don't hesitate to contact me.

Contents

Chapter 1

Number Bases, Conversion and Operations

Reading Materials:
Croft, A. and R. Davidson *Foundation maths.* (Harlow: Pearson, 2016) 6th edition. **Chapter 14 Number Bases**

1.1 Number Bases

Decimal System

The numbers that we commonly used are based on 10.
For example:

$$\begin{aligned} 253 &= 200 + 50 + 3 \\ &= 2(100) + 5(10) + 3 \\ &= 2(10^2) + 5(10^1) + 3(10^0) \end{aligned} \tag{1.1}$$

Binary System

A binary system uses base 2, it only consist of 2 digits, 0 and 1.
Numbers in base 2 are called binary digits or simply bits.
Consider the binary number 110101_2. As the base is 2, this means that power of 2 essentially replace powers of 10. Let us convert it to base 10.

$$\begin{aligned} 110101_2 &= 1(2^5) + 1(2^4) + 0(2^3) + 1(2^2) + 0(2^1) + 1(2^0) \\ &= 1(32) + 1(16) + 0(8) + 1(4) + 0(2) + 1(1) \\ &= 32 + 16 + 4 + 1 \\ &= 53_{10} \end{aligned} \tag{1.2}$$

Octal System

Octal numbers use 8 as a base. The eight digits used in the octal system

are 0, 1, 2, 3, 4, 5, 6 and 7. Octal numbers use powers of 8, just as decimal numbers use powers of 10 and binary numbers use powers of 2. Example:

$$\begin{aligned} 325_8 &= 3(8^2) + 2(8^1) + 5(8^0) \\ &= 3(64) + 2(8) + 5(1) \\ &= 192 + 16 + 5 \\ &= 213_{10} \end{aligned} \tag{1.3}$$

Hexadecimal System

Hexadecimal system use 16 as a base. The digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E and F. Example:

$$\begin{aligned} 93A_{16} &= 9(16^2) + 3(16^1) + A(16^0) \\ &= 9(256) + 3(16) + 10(1) \\ &= 2304 + 48 + 10 \\ &= 2362_{10} \end{aligned} \tag{1.4}$$

1.2 Number Conversion

1.3 Operations with Binary Number

Chapter 2

Series and Sequence

Chapter 3

Modular Mathematics

Chapter 4

Trigonometric Relations

Chapter 5

Functions

Chapter 6

Trigonometric Functions

Chapter 7

Exponential and Logarithmic Functions

Chapter 8

Limit and Differentiation

Chapter 9

Linear Algebra, Vector and Matrices

Chapter 10

Combinatorics and Probability

Bibliography