Week 2 Introduction and Number Systems

Number Systems

In the Lectures last week, you were introduced to different number systems. We shall go through some examples together. One question involves conversion between different bases e.g. decimal to binary, decimal to hexadecimal. There are many methods but the more important thing is to show your working in assignments and the exam.

In the exam, there are no calculators allowed!

Method 1

If you use the division method of base conversion e.g. suppose you are 29 next birthday, 29 is a decimal number and be written 29_{10} where the base is 10. As an example, let us converse 29_{10} to base 5. The division method involves repeated division of 29_{10} by 5 and noting the remainders:

	Remainder
29/5 =5	4
5/5=1	0
1/5=0	1

You stop when 0 is obtained.

Then you **read up** the remainder column to obtain the answer.

So $29_{10} = 104_5$

As a check $104_5 = 1x5^2 + 0x5^1+4x5^0= 25+0+4 = 29_{10}$

What is 5^0?

Note that base 5 has 5 digits 0, 1, 2, 3, 4. There is no digit 5.

Method 2

Another method could have been using the powers of 5:

$5^2 = 25$	$5^1 = 5$	$5^0 = 1$
1	0	4

If you consider 29_{10}, it is made up of one $25= 5^2$, zero 5 and 4 ones or units.

So again $29_{10} = 104_5$

You can use any mathematical method.

Question 1

What is the largest number that you can get with 4 bits, with 8 bits and 16 bits?

Number System Conversion

Question 2

Decimal to Other Base System (binary, octal, and hexadecimal)

Convert the following decimal numbers to binary, octal, and hexadecimal:

1. 117_{10}
2. 127_{10}
3. 128_{10}
4. 255_{10}

Question 3

Other Base System (binary, octal, and hexadecimal) to Decimal

1. Convert 1101_2 to decimal
2. Convert 7014_8 to decimal

Question 4

Other Base System (decimal, binary, octal, and hexadecimal) to Non-Decimal

1. Convert 217_{10} to base 7
2. Convert 1101_2 to base 5
3. Convert 7014_8 to base 9

Question 5

Binary <-> Octal, Binary <-> Hexadecimal

1. Convert $11100\ 1010\ 1110\ 1111\ 1111_2$ to octal
2. Convert $1010\ 1001\ 0101\ 1111\ 1000_2$ to hexadecimal
3. Convert 671_8 to binary
4. Convert DEADFACE_{16} to binary

Question 6 — Binary Addition

Add the following 8 bit numbers and state whether the answer is valid to 8-bit arithmetic.

Show your working especially any “carries”.

1. $1111\ 0000_2 + 1111\ 1111_2$
2. $0111\ 1111_2 + 0011\ 1111_2$
3. $0111\ 0000_2 + 1111\ 0000_2$