Worksheet 10: Number Conversions

Updated: 20th May, 2020

The objectives of this practical are:

- Convert decimal numbers to Binary;
- Convert decimal numbers to Octal;
- Convert decimal numbers to Hexadecimal;.
- Convert directly between binary, octal, and hexadecimal.

Note: This worksheet is not required to be submitted and will not be signed off. **HOWEVER,** the content covered will appear in the exam, it is a good idea to complete the work and discuss any issues with your tutor.

1. Number Systems (Unsigned Integers)

Using the methods from lecture 11, convert the following **integer numbers to binary**, then from **binary to octal**, and **binary to hex** (you could even try octal to hex to test your understanding). The table below provides some significant numbers.

Note: Please do this conversion by hand, as you may be required to do so in the exam.

You can type up the conversion, or scan/photograph your written notes and include the image.

(a) 42

(b) 195

(c) 19809

(d) 29291

Decimal	Binary	Octal	Hex
0	00000000	000	00
1	00000001	001	01
127	01111111	177	7F
128	10000000	200	80
255	...	377	FF
256	...	400	100
32767	...	77777	7FFF
32768	...	100000	8000
65536	...	200000	10000
2147483647	...	17777777777	7FFFFFFF
2147483648	...	20000000000	80000000

2. More Number Conversion!

Now we are going to convert whole numbers (positive and negative) to binary.

> **Note:** Yes, I know you can do this on the calculator but calculators do not allow you to demonstrate your understanding of the process.

Using two's complement convert the following integers to signed binary numbers.

(a) -42 (8-bit)

(b) -19809 (16-bit)

(c) 625 (16-bit)

(d) -129 (8-bit)

Did any problems occur? If so, what was the cause? Why is it important to know how many bits to convert to?

3. Real Number Conversion

The next step is to convert real numbers to binary. For this exercise we will not be using the IEEE float 32 encoding. We will just be converting the numbers to binary.

For example: 42.25 = 101010.01

If you reach 12 decimal places and still do not have a finished answer read the rest of this question. If you understand why it is occurring you may stop, if you do not then talk to your tutor about it:

(a) 72.8125

(b) 6.7182

The lecture notes showed that you cannot completely encode a recurring or irrational number as you run out of room. So, why did you have problems with 6.7182? It is only 4 decimal places, it is not recurring, and certainly not irrational! What other numbers have you seen like this?

Can you think of a reason that numbers like 0.1, 0.085, and 6.7182 would cause problems? How is this related to the '$*2 - 1$' calculation? What does this mean for our ability to store real numbers?

Once you have thought about the above think about what this means when we have to compare real numbers for equality.

4. Octal

Convert the following octal numbers to binary and hexadecimal.

(a) 456271

binary:

hexadecimal:

(b) 36251

binary:

hexadecimal:

(c) 77554

binary:

hexadecimal:

5. Hexadecimal

Convert the following numbers to binary and octal.

(a) 14D

binary:

octal:

(b) ABC

binary:

octal:

(c) 987

binary:

octal:

End of Worksheet