CDS 130
Mid-term exam review

Topics:

1. Binary Number Representation
   1) Bases
   2) Binary to decimal number conversion
   3) Decimal to binary number conversion (the template method and the extended template method)
   4) Decimal to hex number conversion
   5) Binary to hex number conversion

2. Bit Patterns
   1) number of bit patterns for N bits: 2^N
   3) unique combinations of 0s and 1s in N bits: 2^N
   2) the largest integer number represented by N bits(unsigned binary numbers): 2^N-1

3. Binary Arithmetic
   1) Binary number addition
   Rules: 0 + 0 = 0; 0+1 = 1; 1 + 1 = 1 0
   2) Binary number subtraction
   Rules:
   0 – 0 = 0; 1 – 0 = 0; 1 0 - 0 1 = 0 1;
   3) Binary number multiplication
   If the binary number is multiplied by a decimal number which is powers of two (2^N), the binary number shifts to its left by N bits. For example.
   $(10110111)_2 \times (2^8)_{10} = (1011011100000000)_2$

4. Binary representation of negative numbers
   1) sign-and-magnitude representation and its range
   in this method, the data range: $-2^{(N-1)}-1 \sim 2^{(N-1)}-1$

   2) one's complement represenation and its range
   data range of N bits in one's complement: $-2^{(N-1)}-1 \sim 2^{(N-1)}-1$

   3) two's complement representation and its range
   data range of N bits in one's complement: $-2^{(N-1)} \sim 2^{(N-1)}-1$
   Note here: the smallest integer is $2^{(N-1)}$

   4) Excess – K method and its range

   data range: $-K \sim 2^N - N - 1$

5. Binary number subtraction implemented with the 2's complement method using 8 bits:

   $32 - 48 = ?$

   In this case, the two numbers are represented by the 2's complement method:
   $(32)_{10}=(0001\,0000)_2$
   $(-48)_{10}=(11101000)_2$

```
  0 0 0 1  0 0 0 0
+ 1 1 1 0  1 0 0 0
___________________
  1 1 1 1 1 0 0 0
```

   convert (1111 1000) to its decimal counterpart in 2's complement method:
   $(11111000)_2=(-12)_{10}$

6. Encoding
   1) ASCII code (8 -bits).
   2) Encode words
   3) Know how to interpret ASCII codes

7. Computing Limitation
   1) Overflow
   2) Data range represented by N bits

8. Data storage
   1) bits, bytes, words, and doubles
   2) Kilobytes, Megabytes, Gigabytes and Terabytes

9. Logic gates
   1) AND, OR, NOT, NAND, NOR, XOR, XNOR gates
   2) Truth tables for the logic gates
   3) Building a logic gate using universal NAND gates
   3) Find the equivalent logic gate
   4) Output of logic circuits

   MATLAB

10. Variables

    1) Rules for naming variables in Matlab
    begins with a letter, followed by letters, numbers or underscores

    2) Assignment and rules.

counter = 1;
counter = counter + 2;
counter = counter *2;

11. Understand the meanings of symbols
    %
    ;
    :
    ,

12. The meaning of
    clc;
    clear all;

13. Built-in functions in Matlab (note the syntax)
    sin(); cos(); tan(); sind();
    exp(); log(); log10();
    sqrt(); 2^3;
    ceil(); floor(); round();
    mod();
    int8(); int16(); uint8(); uint16(); double()
    input(); display();

14. Math operations in Matlab
    P.E.M..D.A.S
    Powers are writen: 2^3.4, pi^4 in matalab (upper triangle)

15. *anonymous functions and user-defined funcitons
    (1) Write an anonymous function, syntax:
    my_func = @(x,y) x^2 + y^2

    (2) Wirte a script using the "function" command to built a user-defined function
        Note: The .m file name must be consistent with the function name; in the .m file, the key words are
        function f = function_name (x,..)
        end

16. Examine the size of a variable:
    method 1: >> whos A