Final Exam (Dec 22, 2014)

All multiple choice, literally 100 M/C questions.

- 60 questions come from the "theory" part, namely the readings on the left side of the Topics panels and

- 40 questions come from the "practice" part, the right side of the topics panels

Materials:

Topics A to F:

http://www.eecs.yorku.ca/course_archive/2014-15/F/1520/

Textbook: Ch. 1, 2, 3, 4, 5, 10, 11.1, 11.2, 12.3, 15.1, 15.2, 15.3, 16.1, 16.2

Glade Manual: Ch. 1 – 9 (Support chapters from text: 12.1, 12.2, 14.1)

Review on Binary Values, Number Systems

1. To convert from a decimal number (Base 10) to other bases

Step 1: Always divide the decimal number by the new base, write down the quotient and the reminder

Step 2: Divide the quotient by the new base, write down the new quotient and the new reminder

Step 3: Keep repeating step 2 until quotient is 0

2. To convert from Binary to Octal

Step 1: group bits into threes, right to left

Step 2: convert each such group to an octal digit

Ex: what is the Octal representation of 1011010010 ?

Ans: 001 011 010 010 ⬅ Base 2

1 3 2 2 ⬅ Base 8 (Octal representation)

Review on Binary Values, Number Systems

3. To convert from binary to Hexadecimal

Step 1: group bits into fours, right to left

Step 2: convert each such group to a hexadecimal digit

Ex: what is the hexadecimal representation of 1011010010 ?

Ans: 0010 1101 0010 ⬅ Base 2

2 D 2 ⬅ Base 16 (Hexadecimal representation)

Review on Binary Values, Number Systems

4. To convert from Octal to Binary

convert each octal digit to a three-bit binary representation

Ex: what is the binary representation of 745 (Octal) ?

Ans: 7 4 5 ⬅ Base 8 (Octal representation)

111 100 101 ⬅ Base 2

Hence, 745 in octal is 111100101 in binary

Review on Binary Values, Number Systems

5. To convert from Hexadecimal to Binary

convert each hexadecimal digit to a four-bit binary representation

Ex: what is the Binary representation of 745 (Hexadecimal) ?

Ans: 7 4 5 ← Base 16 (Hexadecimal representation)

0111 0100 0101 ← Base 2

Hence, 745 in hexadecimal is 011101000101 in binary

Review on Binary Values, Number Systems

6. To convert from Octal to Hexadecimal

Convert Octal to Binary first and then convert from Binary to Hexadecimal

Ex: Convert 53 (Octal) to Hexadecimal

Ans: 5 3 ← Base 8 (Octal representation)

101 011 ← Base 2

Group the binary digits in groups of 4:

0010 1011 ← Base 2

2 B ← Base 16 (Hexadecimal representation)

Hence, 53 in octal is equivalent to 2B in hexadecimal

Review on Binary Values, Number Systems

7. To convert from Hexadecimal to Octal

Convert Hexadecimal to Binary first and then convert from Binary to Octal

Ex: Convert 53 (Hexadecimal) to Octal

Ans: 5 3 ← Base 16 (Hexadecimal representation)

0101 0011 ← Base 2

Group the binary digits in groups of 3:

001 010 011 ← Base 2

1 2 3 ← Base 8 (Decimal representation)

Hence, 53 in hexadecimal is equivalent to 123 in octal

Review on Binary Values, Number Systems

8. To convert from any bases to decimal (base 10)

Use the following equation (n = number of digits, B = original base, d_i = digit in the i^{th} position in the number) :

$$d_n*B^{n-1} + d_{n-1}*B^{n-2} + \ldots + d_2*B^1 + d_1$$

Ex: Convert 53 (Hexadecimal) to decimal

Ans:

$5*16^1 + 3*16^0 = 80 + 3 = 83$

Ex: Convert 53 (Octal) to decimal

Ans:

$5*8^1 + 3*8^0 = 40 + 3 = 43$

Review: Sample test question

1. Show how the pattern 10111000 translates using each of the following interpretations

Octal:

Hexadecimal:

Two’s complement:

Floating point:

Review: Sample test question

Ans:

Octal: group bits into threes, add “0” to the front if the group has less than 3 bits

010 111 000 ← Base 2

2 7 0 ← Base 8 (Octal representation)

Hexadecimal: group bits into fours, add “0” to the front if the group has less than 4 bits

1011 1000 ← Base 2

B 8 ← Base 16 (Hex representation)

Review: Sample test question

Ans:

Two's complement: invert all the bits and add 1 to find the original magnitude of the decimal number

10111000

01000111 ← Inverted bits

\+ 1 ← Add 1

01001000

01001000 corresponds to decimal 72

Hence, 10111000 corresponds to decimal -72

Review: Sample test question

Ans:

Floating point: 8-bit floating-point format is 1 bit for sign, 3 bits for exponent, 4 bits for mantissa

$$\underset{\text{Sign bit}}{1}\ \ \underbrace{011}_{\text{exponent}}\ \ \underbrace{1000}_{\text{mantissa}}$$

011 in decimal is 3, have to subtract 4 based on excess-4 notation, so 3 - 4 = -1

Hence, the format is: -0.1000×2^{-1}

-0.01000×2^{0} ⬅ Shift the radix point to the left so that the format is expressed in terms of 2^0

$= -0.01$ ⬅ Still in base 2

Hence, -0.01 in base 2 is -1/4 or -0.25 in decimal

Review: Sample test question

2. Given that the ASCII code for B is 66, expressed as a decimal value, what is the ASCII code, in hexadecimal, for the letter G?

Ans: Characters in ASCII table are arranged in alphabetical order, hence:

If the character “B” is 66 in decimal, “C” will be 67 in decimal, … “G” will be 71 in decimal

To convert 71 in decimal to hexadecimal: we keep dividing the decimal number by the new base until the quotient is 0

	quotient	remainder
71/16	4	7
4/16	0	4

Hence, the decimal 71 is 47 in hexadecimal

Review: Sample test question

3. Convert the binary numbers 1010.0110 to decimal representation.

Ans: Consider the integer part first: 1010

To convert to decimal: $1*2^3 + 1*2^1 = 8 + 2 = 10$

Next, consider the fractional part: .0110

To convert to decimal: $0*2^{-1} + 1*2^{-2} + 1*2^{-3} + 0*2^{-4} = 1/4 + 1/8 = 3/8$

Hence, 1010.0110 is $10\frac{3}{8}$ or 10.375 in decimal

Review: Sample test question

4. Convert the decimal number 101.875 to its unsigned binary.

Ans:

	quotient	remainder
101/2	50	1
50/2	25	0
25/2	12	1
12/2	6	0
6/2	3	0
3/2	1	1
1/2	0	1

1100101

0.875*2	=>	1.75
0.75*2	=>	1.50
0.5*2	=>	1.00

111

**we multiply the fractional portion by 2 until the fractional portion equals to zero.

Hence, 101.875 in decimal is 1100101.111 in binary