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| The UWindsor Logo | University of Windsor  Faculty of Science  School of Computer Science | COMP-2650  Computer Architecture I: Digital Design  Winter 2022 |

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| Lec# | Date | Title | | Due Date | Grade Release Date |
| Lec02 | Week 02 | **Number Systems** | Feb. 02, 2022, Wednesday 4 AM EDT | | Feb. 07, 2022 |

The objectives of the lecture (weekly) assignments are to practice on topics covered in the lectures as well as improving the student’s critical thinking and problem-solving skills in ad hoc topics that are closely related but not covered in the lectures. Lecture assignments also help students with research skills, including the ability to access, retrieve, and evaluate information (information literacy).

**Deliverables**

You should answer 2 of the below questions based on your preference using an editor like MS Word, Notepad, and the likes or pen in papers. In the latter case, you have to write and scan the papers clearly and merge them into a single file. In the end, you have to submit all your answers in one single pdf file lec02\_UWinID.pdf containing the question ids for the answer. *Please note that if your answers cannot be read, you will lose marks.* Please follow the naming convention as you lose marks otherwise. Instead of UWinID, use your own UWindsor account name, e.g., mine is [hfani@uwindsor.ca](mailto:hfani@uwindsor.ca), so my submission would be: lec02\_hfani.pdf

**Questions**

**(select only 2 questions based on your preference)**

1. Convert the following numbers to the required bases. Show the steps and the error in conversion with 6 fraction positions compared to when using 15 fraction positions.
   1. (140.23)5 ≃ (?)2
   2. (F.6A )16 ≃ (?)7
2. Determine the base of the numbers in each case for the following operations to be correct.
   1. 14 / 2 = 5
   2. 56 / 4 = 15
3. A binary number (N)2 can be converted to any radix number system *r* = 2n by partitioning the binary number into groups of *n* digits each, starting from the binary point to the left for the integer part and to the right for the fraction part. For instance,

(10 10 11 . 11 11 00)2 = (223.330)4=22

(101 011 . 111 100)2 = (53.74)8=23

Prove it for r = 4 = 22.

1. Conversion from the radix number system *r* = 2n to binary system can be done by reversing the preceding procedure in the assignment (3). For instance, each octal (*r*=23) digit is converted to its 3-digit binary equivalent. Similarly, each hexadecimal (*r* = 24) digit is converted to its 4-digit binary equivalent. E.g.,

(53.74)8 = (101 011 . 111 100)2

(F3.A1)16 = (1111 0011 . 1010 0001)2

Convert the following numbers to binary by the procedure explained:

* 1. (5F.A2)16
  2. (213.32)4

1. Obtain the 1’s and 2’s complements of the following binary numbers by showing the steps:
   1. 10010000
   2. 00000000
   3. 11111111
2. Find the 8’s and the 9’s complement of the following base-9 numbers by showing the steps:
   1. 25,478,036
   2. 00,000,000
3. Given the magnitude of two numbers 01001 and 101, do the following arithmetic in signed-magnitude and signed-2’s-complement form by showing the steps.
   1. (+01001) (+101)
   2. (- 01001) (+101)
4. Given *m* is the number of positions for fraction part of a number in radix-*r*, prove that the maximum fraction number is equal to in the decimal system. For instance, given *m*=3, and *r*=4, the maximum fraction number is (0.333)4, which is equal to (0.984375)10.