CL=CSCI 160

CLASS 3

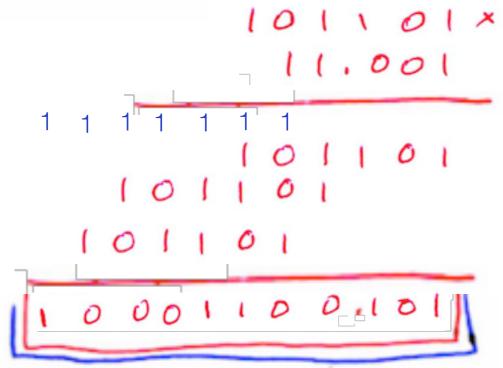
GIVE ANSWERS IN THE SPACES INDICATED BELOW. JUSTIFY YOUR ANSWERS! DO WELL!!!

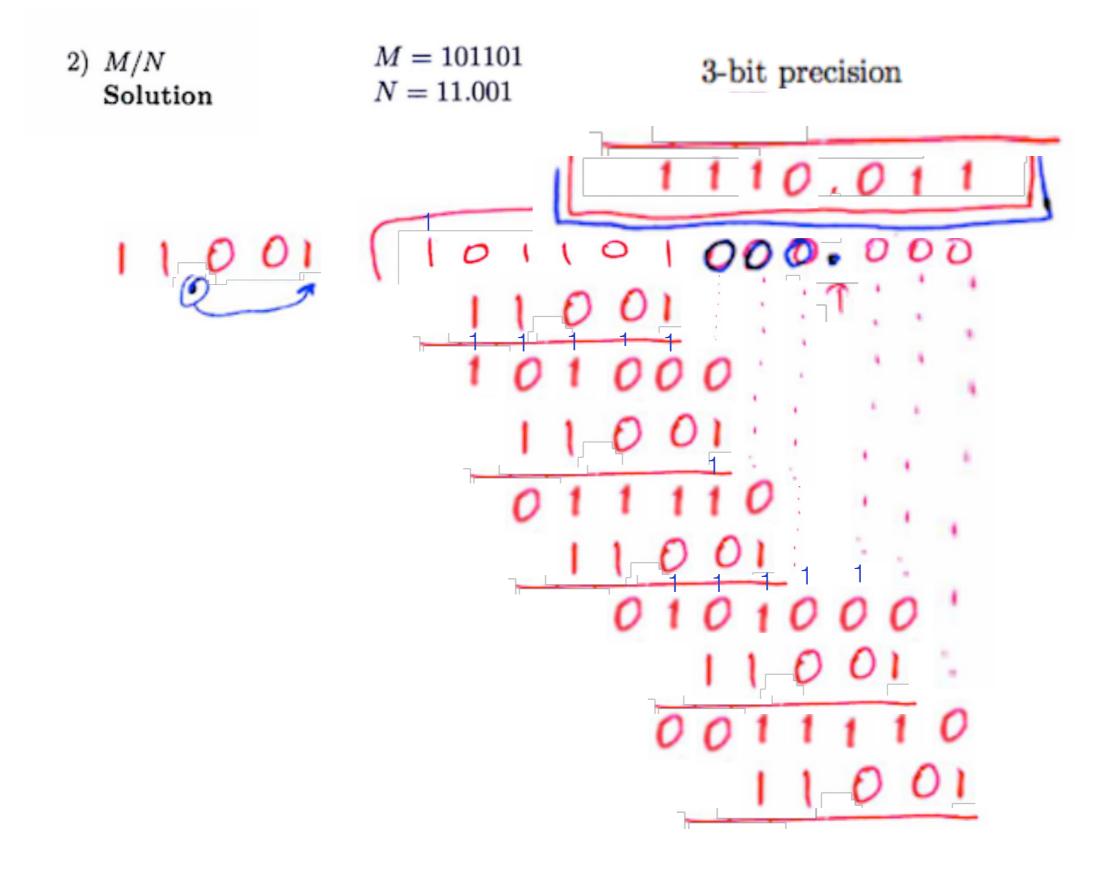
1. Consider the following binary numbers:

M = 101101N = 11.001Using 3-bit precision compute in binary:

1) MN

Solution





2. We have the following equality:

 $24_r + 18_r = 40_r$

where all the numbers are written in the same base r, as indicated. Determine r, and clearly encircle the result.

<u>Solution</u>

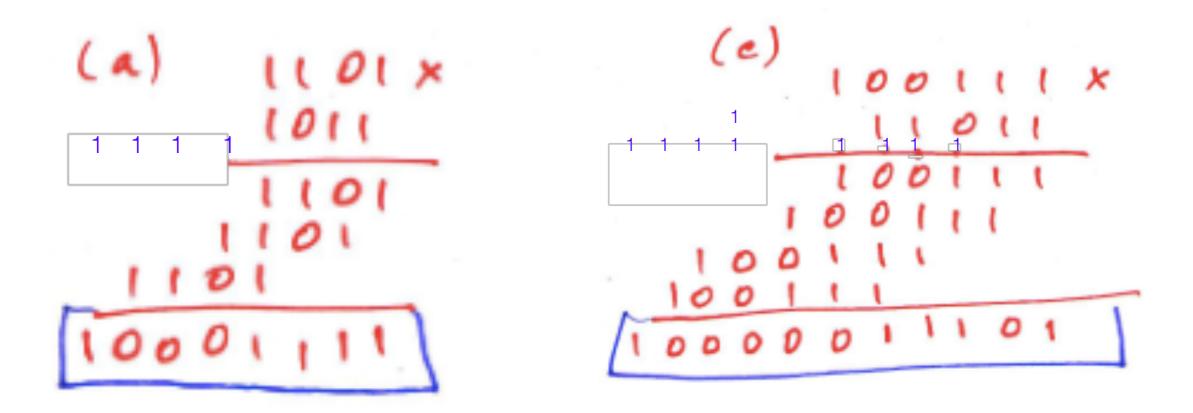
Convert to decimal:

2r + 4 + r + 8 = 4r <-> r = 12

Proof

Prove: $24_{12} + 18_{12} = 40_{12}$, that is: 2x12 + 4 + 1x12 + 8 = 4x12, which is equivalent to: 28 + 20 = 48 True!

1-12. Perform the following binary multiplications:
 (a) 1101 × 1011 (b) 0101 × 1010 (c) 100111 × 011011



1–14. A limited number system uses base 12. There are at most four integer digits. The weights of the digits are 12^3 , 12^2 , 12, and 1. Special names are given to the weights as follows: 12 = 1 dozen, $12^2 = 1$ gross, and $12^3 = 1$ great gross.

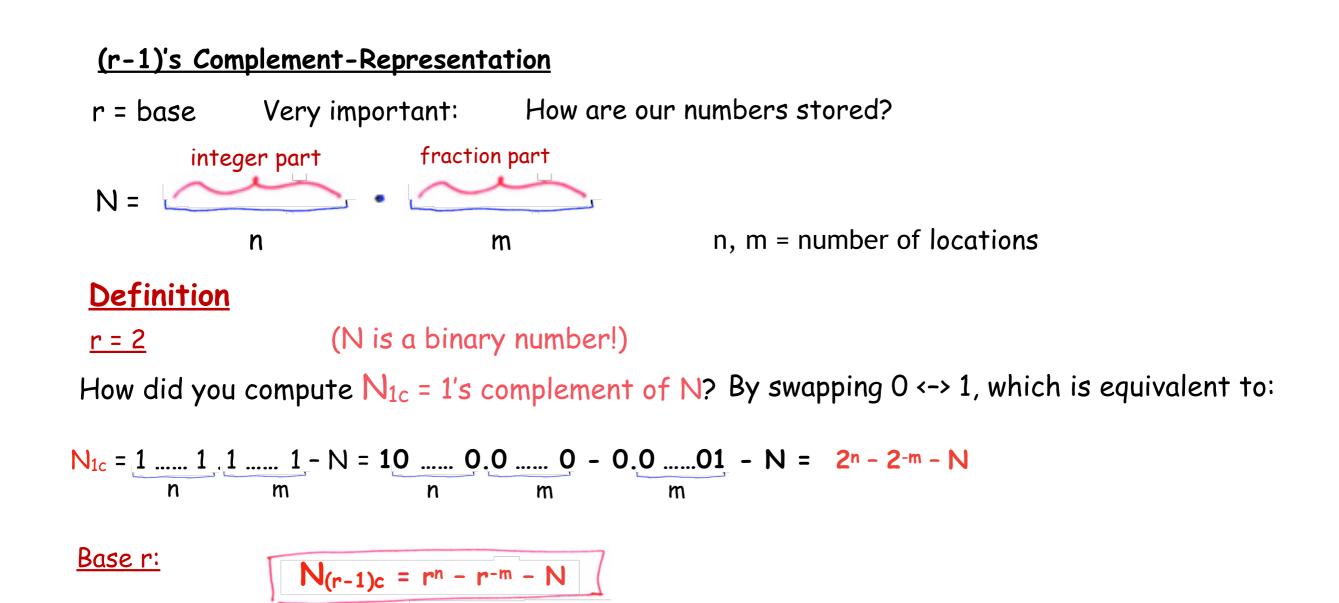
(a) How many beverage cans are in 6 great gross + 8 gross + 7 dozen + 4?
(b) Find the representation in base 12 for 7569₁₀ beverage cans.

$$12 = 144 ; 12^{3} = 1728$$
(a) $6 \times 1728 + 8 \times 144 + 7 \times 12 + 4 = --$
(b) $7569_{10} = 4 gr. gros + 4 gros + 6 dor + 9 = 6912 = 657$
 $= 657$
 $= 776$
 $= 776$
 $= 72$
 $= 4 4 6 9$ base 12

1–16. *In each of the following cases, determine the radix *r*: (a) $(BEE)_r = (2699)_{10}$ (b) $(365)_r = (194)_{10}$

(a)
$$\frac{3}{14} \cdot r^{2} + \frac{5}{14} \cdot r + \frac{5}{14} = 2699$$

 $8r^{2} + Fr = 2699 - 14 = 2685$
alternative 1 (Note: r is a divisor of 2685: factorize it!)
 $r (8r + F) = 2685 = 179 \times 3 \times 5$
 $r (8r + F) = 2685 = 179 \times 3 \times 5$
 $r (8r + F) = 2685 = 0$ Use formula)
 $11r^{2} + 14r - 2685 = 0$ Use formula to solve quadratic equations
to get the result, but the coefficients are large! $r_{1,2} = \sqrt{10} + 5r_{10} + 6r_{10} + 5r_{10} + 6r_{10} + 5r_{10} + 7r_{10} + 7r_{10$



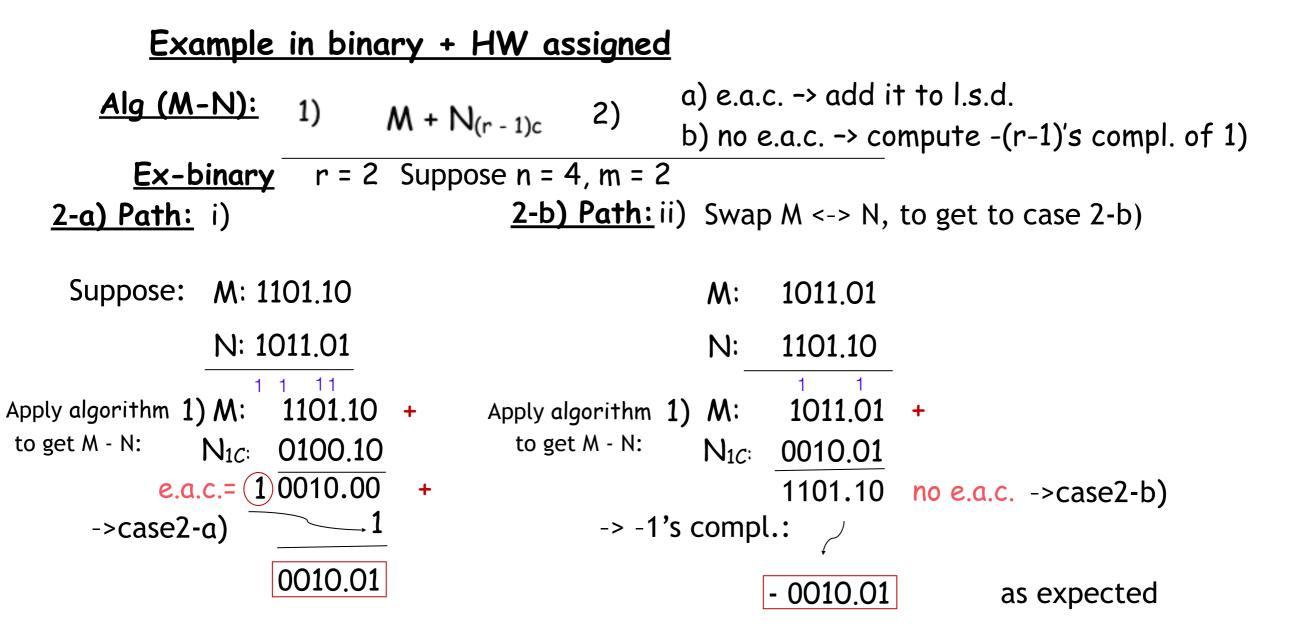
<u>Algorithm for subtracting two numbers using only addition and the (r-1)'s complement</u>

To perform M - N do:

- 1) $M + N_{(r-1)c}$
- 2)
- a) If there is an e. a. c. (= end-around-carry = overflow), then add it to the l. s. d.
 (= least significant digit) of result from 1). Stop.
- b) If there is no e. a. c., then the result is negative, and is obtained by taking the (r-1)'s complement of what we obtained at 1); in other words, we compute:

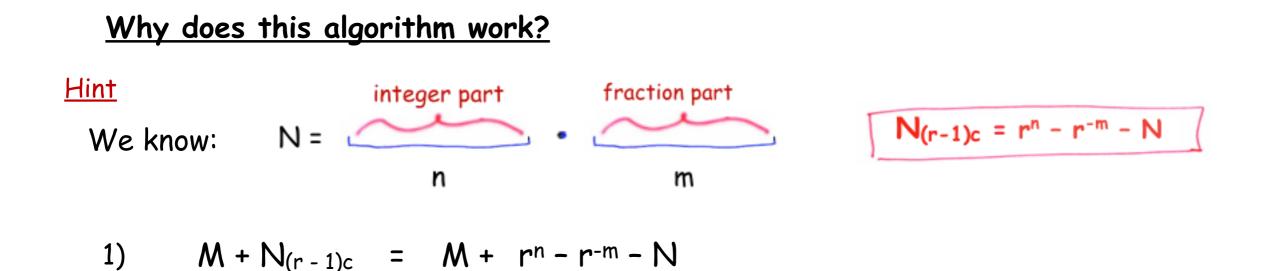
Result from 1)

Stop.

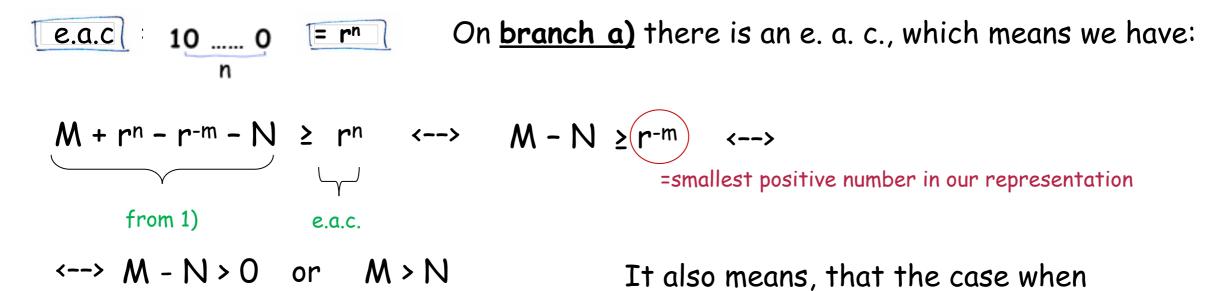


<u>HW</u> (more to follow):

Why does this algorithm work?



2) Whether we follow a) or b) depends on the presence of an e. a. c. What is the magnitude of the e.a.c.? It's an 'overflow':



M - N = 0 will take branch b), which means that 0 will be expressed as -0 by this Alg. Continue justifying the computations in the branches 2-a) and 2-b) as HW.

- 3-A Do the following conversion problems:
 - (a) Convert decimal 34.4375 to binary.
 - (b) Calculate the binary equivalent of 1/3 out to 8 places. Then convert from binary to decimal. How close is the result to 1/3?
 - (c) Convert the binary result in (b) into hexadecimal. Then convert the result to decimal. Is the answer the same?
- 3-B Determine the value of base x if $(211)_x = (152)_8$.
- 3-C Noting that 3² = 9, formulate a simple procedure for converting base-3 numbers directly to base-9. Use the procedure to convert (2110201102220112)₃ to base 9.

3-D The solutions to the quadratic equation $x^2 - 11x + 22 = 0$

are x = 3 and x = 6.

Determine the base of the numbers in the equation.

3-E Convert the hexadecimal number 68BE to binary, and then convert it from binary to octal and then to base 32.