AMERICAN UNIVERSITY OF BEIRUT
Mathematics Department-FAS

MATH 251
TEST 1
FALL 2009-2010
Closed Book, 75 mn

STUDENT NAME	
ID NUMBER	

Problem	Out of	Grade
1	13	
2	14	
3	11	
4	12	
TOTAL	50	

1. Determine the decimal number x in $F(10, 5, -60, +60)$, that has the following hexadecimal representation in the IEEE single precision system. **(If needed, round to the closest and use nested polynomial evaluation.)**

$$x = [\,1B\,1A\,1A\,1B\,]_{16}$$

2. To establish Newton's iterative scheme - **not involving division by the iterate**- that approximates the negative number

$$a = -\frac{\mathbf{1}}{\mathbf{5^{1/3}}}$$

Determine:

(a) The function to be used

(b) The graph of f

(c) The iterative formula of Newton's method

(d) The restrictions on the initial conditions, if any:

(e) Calculate $a = -\frac{\mathbf{1}}{\mathbf{5^{1/3}}}$ up to 2 decimal places. Express all your answers in $F(10, 4, -20, +20)$, and round to the closest if neded.

3. The following Algorithm approximates the root r of a function $f(x)$ using **the SECANT method**

   Input f, a, b,TOL, kmax

   function[...............]=mySecant(...)

   Find the first 2 approximations by the " Bisection rule"

   k=2; RelErr = 1;

   while ....

   Display : 'the best approximation to the root is r=........'

4. (a) - Solving the quadratic equation

$$x^2 - (2 \times 10^5)x - 10^{-4} = 0$$

in the normalized floating point system $\underline{F(10, 5, -20, +20)}$ will cause a problem if the standard equations for the roots of x_1 and x_2 are used. Investigate the example, **observe and discuss the difficulties**, and propose a remedy.

<u>In $F(10, 5, -20, +20)$</u>

$\Delta =$

$x_1 =$

$x_2 =$

(b) - (i) -Find the IEEE Single precsion binary bit string representation of the midpoint of the interval $(0, x_{min})$.

$(x_d)_{midpoint} =$

Bit-string representation of $(x_d)_{midpoint}$ in IEEE single precision:

(ii) - If fl_p represents rounding to the closest, what is $fl_p(x_d)_{midpoint}$ in F_S ?

$fl_p((x_d)_{midpoint}) =$