AMERICAN UNIVERSITY OF BEIRUT
Faculty of Arts and Sciences
Mathematics Department .

MATH 251
Quizz I
Fall 2008 – 2009
Closed Book, 75 minutes

STUDENT NAME : .

ID NUMBER : .

Problem 1 (11 points): .

Problem 2 (7 points): .

Problem 3 (9 points): .

Problem 4 (15 points): .

Problem 5 (8 points): .

1. Determine the hexadecimal representation of the decimal number $x = (-285.756)_{10}$ in **single precision**. Use the <u>octal system</u> as an intermediate stage.

(11 points)

2. (a) - What is the bit string representation of the denormalized number x_d in the IEEE single precision floating point system F_S. (Use $fl = fl_0$ if needed)

$$x_d = \sum_{k=127}^{150} 2^{-k} = 2^{-127} + 2^{-128} + 2^{-129} + \ldots + 2^{-150}$$

(b) Find $succ(x_d)$ and identify this element

(7 points)

3. –Determine the values of x for which the following functions involve a difficulty. What is it ? What remedy do you propose ?

(9 points)

a – $f(x) = \dfrac{e^{2x} - 1}{2x}$

b – $g(x) = \sqrt[4]{x+4} - \sqrt[4]{x}$

4. The reciprocal of the cubic root of 2 (i.e. $\frac{1}{2^{1/3}}$), can be computed by an iterative formula that does not use division by the iterate.

(15 points)

a – Establish this formula by applying Newton's method to some appropriate function f(x) and draw its graph.

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b – Determine any necessary restrictions on the choice of the initial value r_0 of this iterative procedure. Give a graphic justification to the necessity of this restriction.

c – Approximate $\frac{1}{2^{1/3}}$ up to 3 decimal places. Compare the number of iterations needed to reach this precision with the predicted number of iterations of the Bisection method. Justify your results.

5. - Fill in the missing statements in the following Matlab program that computes the polynomial p(x) for $x \in R$, using nested multiplication.

$$p(x) = a(1) + a(2)x + a(3)x^2 + ... + a(n+1)x^n$$

- Find then the number of floating point operations needed to execute the algorithm. (Detail your counting)

(8 points)

function [p]= Nested(*a*, x)
% Input arguments: the vector *a* representing the coefficients *a*(1), *a*(2), …, *a*(n+1), and
% a real number x
% Output argument : p = p(x) : the value of the polynomial at x

m = ………………………………………………..**;** % the number of components of *a*
p = ………………………………………………...**;** % Initialize p
for i = ………..**:**………………**:**…………………
    p = ……………………………………………..;
end

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