University of Jordan
Elect. Eng. Dept.

Numerical Methods 903301 | First Exam | Tuesday 6/3/2018

Student Name: | Reg. No.

Answers should be written in ink | **Exam Duration: 70 min** | Mark out of 30

Q1 a) Imagine a decimal computer which uses **6** decimal digits and number normalization . For floating point arithmetic, **number rounding** is used , and **1,1,2,and 2** decimal digits are allocated for the number sign, exponent sign, the exponent , and the significand (mantissa) respectively. With this computer in mind, answer the following. **(12 marks)**

what is the **maximum positive floating point number** given by this computer .

What **floating point answer** will this computer give for $(0.5\times10^{55})^2$.

What result does this computer give for $\frac{\sqrt{19}}{\sqrt{5}}$? .

Is this computer good for representing **(1/250)** $_{10}$ exactly?. If yes, what is the answer represented as a floating point

b) Assuming a computer follows a **1114** decimal digit allocation with number **chopping**.
What result this computer gives for $\sqrt{x^2+1}-x$ at **x = 65.43** .

Suggest an equivalent rearrangement to improve the accuracy. What is the new result now?

c) A **base 5** computer follows a **1113** digit allocation with number chopping. Using this computer.

i)What is the floating point number representation of **(2.5)** $_{10}$?

What is the **percent true relative error** involved?

ii)What is the signed **minimum integer number** that is possible with this computer.

iii) Without numerical validation, Can **3.03235 2143** in base 5 represent π ? Why ?

Q2) Write a MATLAB **m.file program** to determine a zero of the function $e^{x} - 2x - 1$ using the **bisection** method. The program stops when it satisfies an approximate **relative error** of **10^{-8}**. It prints out a **table** containing the **iteration number as integer**, **the value of the approximate zero,** and the **percent relative error** at that iteration. The print out should show **6** digits to the right of the decimal point of the floating point variables being printed out. **(7 marks)**

Q3 a) A zero of $f(x) = x^2 - x - 1$ is ~~1.617647059~~ 1.618033988749895 which is known as the golden ratio **GR** . To determine it iteratively, choose **<u>two</u> convergent** rearrangements for $f(x)$ in the form $x_{i+1} = g(x_i)$. Then, Choose a third rearrangement to determine the second zero. Start all three iterative calculations with $x^0 = 1.5$. List down the first **4** iterations only. **<u>Don't</u> use the Newton-Rhaphson method as one of the choices . (6 marks)**

Space for your final *g(x)*	Results of the first **4** iterations
First choice to determine **GR**	
Second choice to determine **GR**	
Third choice to determine the **second zero**	

Q4 To confirm the value of **GR** obtained in **Q3** , use the **<u>false position method</u>** in the interval **[1 2]** .
Perform **~~two~~** iterations only. **(5 marks)**
three

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