NAME:
AME 20214
Introduction to Engineering Computing
Examination 1
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15 October 2015

1. (5) Write LaTeX script which generates the following equations with the given format:

$$\begin{aligned} x &= r\cos\theta, \\ y &= r\sin\theta. \end{aligned}$$

2. (10) Give the output of the following `Fortran` statements:

   (a) `print*, 1/2*2`
   (b) `print*, 1/2.*2.`
   (c) `print*, 1./2.*2`
   (d) `print*, 1./2./2.`
   (e) `print*, 1._8/1`

3. (5) The hexadecimal system is a base 16 system. It first sixteen numbers are

$$0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f.$$

   Their base 10 equivalents are

$$0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15.$$

   Represent the base 10 number 64 in hexadecimal.

4. (10) Convert the following mathematical expression into `Fortran` code

$$x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}.$$

5. (5) Write the `UNIX` commands for

   (a) creating a directory named `mydirectory`,
   (b) removing a directory named `mydirectory`.

TURN THE PAGE!

6. (20) Carl Friedrich Gauss (1777-1855) while in grade school was asked to add all of the integers between 1 and 100 (including 1 and 100). Write a `Fortran` code to achieve this end. You only need to write the code; however, *if* you are also able to report the numerical value (as Gauss famously and quickly did without the benefit of a computer) of the result, there will be a special award.

7. (10) Give the output of the following program

```
program test
integer :: i,j,k
do i=2,8,2
    do j=i,2
        do k = 1,j,2
             print*,i,j,k
             enddo
         enddo
      enddo
end program test
```

8. (30) Consider a matrix $\mathbf{A}$ of dimension $N \times M$ and a vector $\mathbf{x}$ of dimension M. All elements of $\mathbf{A}$ and $\mathbf{x}$ are to be real double precision numbers. Write a complete `Fortran` code that

   (a) reads from the screen the variable array dimension N and M,

   (b) reads from the screen each of the elements of $\mathbf{x}$,

   (c) reads from the screen each of the elements of $\mathbf{A}$,

   (d) builds a vector $\mathbf{b}$ formed by the matrix multiplication $\mathbf{b} = \mathbf{A} \cdot \mathbf{x}$.

   (e) prints each element of $\mathbf{b}$ to the screen.

   Use a `do` loop to compute $\mathbf{A} \cdot \mathbf{b}$. Do not use `matmul`.

9. (5) Write a short `Fortran` program which prints to the screen

   `Go Irish!  Beat Trojans!`

   Have the program also print to the screen an estimate of the final score.