HW 4

Total Points: 25 | **Due Date: March 6, 2015**

1. **(10 points)** The Taylor series expansion for cos(x) is:

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^2}{4!} - \frac{x^6}{6!} + \cdots = \sum_{0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n}$$

   where x is in radians. Write a MATLAB program that determines $\cos(x)$ using the Tylor series expansion. The program asks the user to type a value for an angle in degrees. Then the program uses a loop for adding the terms of the Taylor series. If a_n is the nth term in the series, then the sum S_n of the n terms is $S_n = S_{n-1} + a_n$. In each pass calculate the estimated error E given by $E = \left|\frac{S_n - S_{n-1}}{S_{n-1}}\right|$. Stop adding terms when $E \leq 0.000001$. The program displays the value of $\cos(x)$. Use the program for calculating:

   (a) $\cos(35^{\circ})$ (b) $\sin(125^{\circ})$

   Compare the value those obtained by using a calculator

2. **(5 points)** The value of π can be estimate by :

$$\sqrt{6\left(\sum_{n=1}^{\infty} \frac{1}{n^2}\right)}$$

Write a program (using a loop) that determines the expression. Run the program with $n = 100, n = 10000,\ and\ n = 1000000$. Compare the result with MATLAB pi commnad (Use format long).

3. **(10 points)** The reciprocal Fibonacci constant Ψ is defined by the infinite sum:

$$\Psi = \sum_{n=1}^{\infty} \frac{1}{F_n}$$

where $F_n$are the Fibonacci numbers 1, 1, 2, 3, 5, 8, 13,….. . Each element in this sequence of numbers is the sum of the previous two. Start by setting the first two elements equal to 1, then $F_n = F_{n-1} + F_{n-2}$. Write a MATLAB program in a script file that calculates Ψ for a given *n*. Execute the program for *n* = 10, 50, and 100.