University of Maryland at College Park
Department of Civil & Environmental Engineering

Quiz 1 Solution, **Closed Book & Notes, for 15 minutes**
September 10, 2001

ENCE 302
Probability and Statistics for Civil Engineers   Name:_____

Problem

Develop a Taylor series expansion for the following function for three terms:

$$f(x) = x^2 - 2x^{0.5} + 2$$

Use $x_0 = 1$ as the base (or starting) point and h as the increment. Evaluate the series for $x = 1.1$ and 1.5, and, compare your results with the true value for both cases. NOTE: Taylor series expansion is given by:

$$f(x_0 + h) = f(x_0) + hf^1(x_0) + \frac{h^2}{2!}f^2(x_0) + \frac{h^3}{3!}f^3(x_0) + ... + \frac{h^n}{n!}f^n(x_0)$$

**** Solution****

For $x = 1.1, \; h = 0.1$ and   for $x = 1.5, \; h = 0.5$

$$f(x) = x^2 - 2x^{0.5} + 2 \qquad \Rightarrow \qquad f(1) = 1$$

$$f'(x) = 2x - \frac{1}{\sqrt{x}} \qquad \Rightarrow \qquad f'(1) = 2(1) - \frac{1}{\sqrt{1}} = 1$$

$$f''(x) = 2 + \frac{1}{2x^{1.5}} \qquad \Rightarrow \qquad f''(1) = 2 + \frac{1}{2(1)^{1.5}} = 2.5$$

$$f(1.1) = f(1 + 0.1) = 1 + 0.1(1) + \frac{(0.1)^2}{2}(2.5) = 1.1125 \qquad \text{True value} = 1.1124, \; \text{Abs Error} = 0.0001$$

$$f(1.5) = f(1 + 0.5) = 1 + 0.5(1) + \frac{(0.5)^2}{2}(2.5) = 1.8125 \qquad \text{True value} = 1.8005, \; \text{Abs Error} = 0.0120$$

As the separation distance (h) gets smaller, the solution converges to true value

Problem 2

If a pair of dice rolled simultaneously, what is the probability that the sum of the dots is

    a. 6
    b. 1
    c. an even number
    d. an odd number

SECOND DIE

	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
FIRST DIE	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

*** Solution ***

a. $\dfrac{5}{36} = 0.1389$

b. $\dfrac{0}{36} = 0$

c. $\dfrac{18}{36} = \dfrac{1}{2} = 0.5$

d. $\dfrac{18}{36} = \dfrac{1}{2} = 0.5$