Mathematics and Modeling for Finance

HW3: Due on November 10, 2006

1) Show in all details the formula

$$Var(\alpha X + \beta Y) = \alpha^2 Var(X) + 2\alpha\beta \, covar(X,Y) + \beta^2 Var(Y)$$

2) Simulate set of measurements of events that occur with the frequency of 48 $\frac{events}{day}$, measured by 2 hours time-slots. Set should contain at least 100 measurements. Calculate mean value and the variance of measurements and comment on the obtained results. [Hint: for individual measurements choose the result according to the Poisson distribution.]

3) Generate at least 10,000 random numbers from the probability density function $f(x) = \frac{2}{3}(1+x)$ on the interval [0,1], using the inversion method. Demonstrate that the generated random numbers are indeed distributed according to f by plotting their distribution using 100 bins on the interval [0,1], and comparing it with the function f.

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4) Find zeros of the function $f(x) = x^2 + x^3$ analytically, and numerically, using bisection and Newton-Raphson method.

5) Solve $f(x) = 0$ for $f(x) = \cos x$ on the interval $[0, \pi]$ using bisection and Newton-Raphson method.

6) Find all zeros of the function $f(x) = x^2 - 2x^5 - 0.1$ on the interval $[-2, 2]$. (Bisection)

7) Find all zeros of the function $f(x) = x \sin x - 0.5$ on the interval $[-1, 1]$. (Newton-Raphson)

8) If the present value of the following cash flow stream $(1000, 1200, 1000, 1000, 1200)$ is 5000, what is the appropriate interest rate? Cash flows start one time period from now.

9) Find all zeros of the function $f(x) = \dfrac{8x}{(1+x)^3} - 1$ on the interval $[0, 2]$.

10) Find all zeros of the function $f(x) = 5x^4 - \dfrac{x}{1+x^4}$ on the interval $[0, 1]$.

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