Week 14: Reading Assignment, Homework Assignment

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Course Website: http://courses.physics.illinois.edu/phys598aem/

All lecture notes, homework, demos, references, *etc*. are available on the P598AEM website. Please spend some time checking these out!

Course Organization:

A. Lectures: Tuesday & Thursday, 12:30-1:50 pm, in 136 Loomis.
B. Weekly Reading and Homework Assignments: HW due following Thursday, in class.
C. Take-Home Midterm Exam: Oct. 10th, due Oct. 17th (in lieu of P598AEM HW 7).
D. Take-Home Final Exam: Dec. 10th, due Dec. 17th.

Reading Assignment For Week 14: Please read/work through P598AEM Lect. Notes 26-27.
Homework Assignment For Week 14: See/do HW # 14 problems on following pages.

Physics 598AEM Week 14 Homework Assignment

Use a suitable software package that has a ***uniform*** random number generator $U(0,1)$ to do the following HW problems:

1.) Make a histogram of a statistically significant # of calls to $U(0,1)$, *e.g.* 1K, 10K calls.

2.) Make the necessary transformation to obtain $U(-1,1)$. Make a histogram of your $U(-1,1)$.

3.) If u_1 is drawn from $U(0,1)$, then show (*i.e.* histogram) $u_2 = 1 - u_1$ is also drawn from $U(0,1)$.

4.) If (u_1, u_2) are a pair of ***independent*** random variables drawn from $U(0,1)$, compute:

$$z_1 = \sqrt{-2\ln u_1}\cos(2\pi u_2) \qquad \text{and} \qquad z_2 = \sqrt{-2\ln u_1}\sin(2\pi u_2)$$

and show (*i.e.* histogram & scatterplot) z_1 and z_2 to determine whether or not they are ***independent*** and whether or not each ***is*** distributed as $N(0,1)$, *i.e.* $g(z_1) = \frac{1}{\sqrt{2\pi}} e^{-z_1^2/2}$, $g(z_2) = \frac{1}{\sqrt{2\pi}} e^{-z_2^2/2}$ and $g(z_1, z_2) = \frac{1}{\sqrt{2\pi}} e^{-z_1^2/2} \frac{1}{\sqrt{2\pi}} e^{-z_2^2/2}$. If they are not, please comment…

5.) Define the constants $\tau = 10$, $a = 0$ and $b = \infty$, and then compute $\alpha \equiv e^{-a/\tau}$ and $\beta \equiv e^{-b/\tau}$. If u is drawn from $U(0,1)$, then histogram $t = -\tau \ln\left[\beta + u(\alpha - \beta)\right]$ on a semi-log plot. What happens if $a = 2$ and $b = 20$?