Week 10: Reading Assignment, Homework Assignment

Lecturer: Prof. Steven Errede
Email: **serrede@illinois.edu**
Office: 435 Loomis (4th floor, SW corner)
Office Phone: 333-0074. HEP Sec'ys: 441 Loomis (333-4452)
Office Hours: Anytime

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. 17h (in lieu of P598AEM HW 7).
D. Take-Home Final Exam: Dec. 10th, due Dec. 17th.

Reading Assignment For Week 10: Please read/work through P598AEM Lect. Notes 18-19.
Homework Assignment For Week 10: See/do HW # 10 problems on following pages.

Physics 598AEM Week 10 Homework Assignment

1.) The P.D.F. for exponential decays is $f(t;\tau) = \frac{1}{\tau} e^{-t/\tau}$.

a.) Verify that the P.D.F ***is*** indeed properly normalized, *i.e*. that: $\int_0^\infty f(t;\tau)\,dt = 1$.

b.) Calculate the ***true mean*** lifetime $\hat{t}$ using: $\hat{t} \equiv E[t] = \int_0^\infty t \cdot f(t;\tau)\,dt$.

c.) Calculate the ***true variance*** and the ***true standard deviation*** using:
$\text{var}(t) \equiv \sigma_t^2 \equiv E[(t-\hat{t})^2] = \int_0^\infty (t-\hat{t})^2 \cdot f(t;\tau)\,dt$ and $\sigma_t = \sqrt{\sigma_t^2}$.

2.) A physicist measures the individual decay times of ***seven*** events, listed in the table below.
a.) Use the M.L.M. to obtain the "***best***" ***estimate*** of the ***mean*** lifetime τ^*, the ***variance*** $\sigma_{\tau^*}^2$ and the 1-σ ***standard deviation*** $\sigma_{\tau^*} = \sqrt{\sigma_{\tau^*}^2}$.

Event #	Decay Time
1	0.511572
2	14.647381
3	4.994859
4	7.215827
5	1.150754
6	2.716817
7	7.842374

b.) Compare your M.L.M. results with the MC ***true mean*** lifetime for this data sample: $\hat{\tau} = 10.000$ time units, and also the ***true variance***, and the ***true*** 1-σ ***standard deviation***.