Recitation assignment due in recitation 2 - 2 - 10. See chapters 16 and 17.

Reminder: Exam 1 is 2-3-10. Lecture 1-27-10 will be very important in getting you started with the material below.

Errata:

On page 426 it is said that "410, 420. A random variable that can take any numeric value within a range of values is called a continuous random variable.." This is incorrect. To see the difficulty imagine that I flip a coin and if heads occurs I say X = 1, otherwise I spin a pointer and announce X as the angle, in infinite precision degrees 0 to 360, at which the pointer comes to rest. X may take any value in the interval [0, 360] but is not continuous since there is discrete probability 0.5 that X takes the value 1. See lecture notes 1-27-10.

On page 426 it is said that "410. The probability model is a function that associates a probability P with each value of a discrete random variable X, denoted P(X = x), or with any interval of values of a continuous random variable." They should have said "The probability model for a random variable X.. ." To see the difficulty consider the probability model usually specified for the toss of a coin which consists of the set {H, T} of possible outcomes having respective probabilities {0.5, 0.5}. If you code the model numerically such as outcomes {0 for T, 1 for H} with respective probabilities {0.5, 0.5} you have another probability model whose possible outcomes {0, 1} are numeric. This model is what the authors are talking about in 410. This model is also called the probability distribution of random variable X. We must not make the oversight of ruling out {H, T}, {0.5, 0.5} as a probability model and we must recognize that we are talking about a probability distribution on the real line commonly referred to as the probability distribution of a random variable X.

1-12. Random variable X has the following distribution (some useful calculations are shown):

x	p(x)	x p(x)	$(x -(-0.7))^2$ p(x)	x^2 p(x)
0	0.2	0	0.49 0.2	0 0.2
1	0.3	0.3	2.89 0.3	1 0.3
-2	0.5	-1.0	1.69 0.5	4 0.5
totals	1.0	- 0.7	1.81	2.3

Confirm all calculations of the table before proceeding.

1. Determine E X =
(see pg. 411)

2. Directly read Variance X from the table =
(see pg. 413)

3. Calculate Variance X = E X^2 - $(E X)^2$ =
(see that your answer agrees with #2)

4. Determine E (3 X + 7) =
(see pp. 414-415)

5. Determine E (3 X - X - 6) =

6. Determine Variance of (3 X + 7) =
(use rules, see pg. 415)

7. Determine Variance of (3 X - X + 7) =
(merge 3 X with -X first)

8. If Y is a random variable with E Y = 6 determine E(X - 2Y + 4) =
(use rules, see pg. 415)

9. If Y is a random variable **independent of** X with Variance Y = 2 determine Variance of (5 X - Y + 11) =
(see pg. 416)

10. Determine the standard deviation of random variable X (written SD or "sigma" or σ, or σ_X when we wish to specify which random variable it is the standard deviation of.
(see pg. 426)

11. Determine the SD of random variable (3X - 2X + 4) =
(use the rules, see pg. 426, be careful since 3X and X are not independent!)

12. Refer to #9. Determine the standard deviation of (5 x - Y + 11).
(use rules, see pg. 426)

13-17. Lottery 1 returns random variable X having expectation 17 and variance 4. Lottery 2 returns random variable Y having expectation 30 and variance 9. We are invited to play each of these but it will cost us 2 to play for X and 3 to play for Y. As a bonus, we will earn 1.4 X instead of X.

13. In terms of X, Y, 2, 3, 1.4 express a random variable describing our actual NET return R if we accept the offer.

14. Using the rules determine E R =

15. Using the rules determine Variance of R if X, Y are **independent**.

16. From #15 give the SD of R =

17. If each of X, Y follows a normal distribution the so will R (provided X, Y are independent, see pg. 422). Assuming that R follows a normal distribution sketch the distribution with the mean and SD in place and determine a 68% Interval around the mean.

Refer to chapter 17. Before exam 1 we will cover only the definition of Bernoulli Trials, the binomial distribution and its normal approximation, and the Poisson distribution and its normal approximation.

18-22. A fair coin will be tossed 100 times (any H counts as a "success").

18. What are the number n and probability p of Bernoulli trials?
(see pg. 433)

19. Define random variable X as the number of heads seen in executing #18. Determine E X = , Variance X = , SD X =

20. Verify the condition (pg. 439) whereby we may approximate the distribution of X by a normal and sketch the normal approximation of the distribution of X labels included.

21. Use #20 to fill out the following:
P(X falls in the range [,]) ~ 0.68
P(X falls in the range [,]) ~ 0.95
P(we get between 40 and 55 heads in 100 tosses) ~

22. Determine the approximate 68% interval for the number of heads in 10,000 tosses of a fair coin.

23-27. A fair six-sided die will be tossed 100 times (any "ace", i.e. face ⚀ turning up, will be counted as a "success").

23. What are the number n and probability p of Bernoulli trials?
(see pg. 433)

24. Define random variable X as the number of aces seen in executing #23. Determine E X = , Variance X = , SD X =

25. Verify the condition (pg. 439) whereby we may approximate the distribution of X by a normal and sketch the normal approximation of the distribution of X labels included.

26. Use #25 to fill out the following:
P(X falls in the range [,]) ~ 0.68
P(X falls in the range [,]) ~ 0.95

27. Determine the approximate 68% interval for the number of aces in 10,000 tosses of a fair die.

28-31. A hospital averages around 4.7 emergency admissions for eye injury per night. Past experience indicates that these counts X of rare events are acceptably modelled by the Poisson distribution.

28. Determine E X =

29. Determine SD X =

30. Since E X $\geq$ 3, sketch the normal distribution approximating the distribution of X = # admitted with eye injury in a given night. Label mean and SD.

31. Determine a 95% interval for X. Would you be surprised to see so many as 9 admissions for eye injury in a given night? Why?