

Weeks 6 and 7
October 12-21, 2005

Topics: Continuous RVs (Conditioning, Multiple RVs, Derived Distributions)

1. Recitation 10: Thursday, Oct 13

- (a) Discuss the basic formulation of conditioning for continuous random variables and then use Problem 1 as an example. For problem 1, please note that the book solution is incomplete (see Rec 10 solutions).
- (b) Point out the memoryless property of the exponential in problem 1.
- (c) Derivation of the PDF from the CDF in Problem 1 is meant to give them a hint about derived distributions next week.
- (d) Review joint PDFs for continuous RVs. Problem 2 is meant to help them visualize the connection between joint, marginal, and conditional PDFs and independence and also to give them practice in setting up the associated integral equations. This will be useful for derived distributions next week.
- (e) Problem 3 covers Bayes' Rule, and is a nice followup to the communication problem we covered last week. Students often like to see application of theory, so one could also go a step further and ask students where the appropriate threshold should be set to sense -1 or 1 (start with $p = 1/2$ to make things simple). This is essentially a maximum-likelihood approach to estimation.

2. Recitation 11: Tuesday, Oct 18

- (a) Review the two rules of derived distributions: computing the CDF and then differentiating to get the PDF. I would suggest spending very little time on review, and focus primarily on problems in this recitation.
- (b) In problem (1), I would recommend starting by quickly deriving the CDF of an exponential RV and placing it on the board where it will not be erased. Use of this CDF will save you time in both problems 1 and 4.
- (c) Problem (1): part (a) provides a basic example, and part (b) provides a nice lead-in to generally obtaining the PDF for a linear function of a RV.
- (d) Problem (2): this problem is meant to demonstrate the usefulness of obtaining the PDF for a linear function of a RV. It would be hard to otherwise achieve this calculation since there is no closed form solution for the Gaussian integral.
- (e) Problem (3): provides a fairly straightforward example in dealing with multiple RVs where boundary conditions are trivial.
- (f) Problem (4): Provides a more advanced example that requires attention to boundary conditions. Be sure to use the previously derived exponential CDF to save time.

3. Tutorial 5: Oct 13/14

- (a) Stress intuition behind total expectation theorem. Highlight the use of the CDF function and reiterate Baye's theorem.
- (b) Stress the practical use of Baye's rule for inference. Highlight how the parameter is now defined by a distribution instead of a fixed value as we have used before and reiterate how the distribution changes with new data.
- (c) Use this problem to stress how to visualize conditional distributions. Reiterate the use of total expectation theorem.

4. Tutorial 6: Oct 20/21

- (a) Use this problem to illustrate how the CDF is useful in obtaining derived distributions.
- (b) A drill problem to give another example of how the CDF is used to obtain the derived distribution.
- (c) Use the word problem to emphasize that we need to consider multiple solutions to the derived variable (illustrate how we need to use multiple areas of integration in obtaining the derived CDF)
- (d) Emphasize visualization