# 332:541 Stochastic Signals and Systems Fall 2007

Pre-Quiz I

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*You have 20 minutes to complete this short preparatory quizlette. PRINT your full name on THIS side and place your answers and work on BOTH sides of the test sheet. You may use scratch sheets, but ONLY the test sheet will be collected. The point values shown are also suggested time budgets (in minutes) for each problem. This quizlette has a total of 20 points.*

1. *(1 point)* Evaluate $\int_{-\infty}^{\infty} f_{X|Y}(x|y) f_Y(y) dy$

2. *(1 point)* You are given $f_{X|Y}(x|y)$ and $f_{Y|X}(y|x)$. What is the ratio $f_X(x)/f_Y(y)$?

3. *(1 points)* If independent random variables $X$ and $Y$ have Gaussian PDFs with zero means and variances $\sigma_x^2$ and $\sigma_y^2$ respectively. What is the PDF of the random variable $Z = X - Y$?

4. *(5 points)* For the previous problem, what is $f_{ZY}(z, y)$?

5. *(12 points)* A random variable $X$ is derived from the following experiment:

   - Roll a fair $k$-sided die ($k \geq 2$ a positive integer).
   - If side $s \in [1, 2, ..., k]$ turns up, $X$ is chosen from a continuous guniform distribution on $[-s/2, s/2]$.

   (a) *(3 points)* Provide an analytic expression and/or carefully labeled sketch for $f_X(x)$?

(b) *(1 point)* What is Prob$[X = 0]$?

(c) *(8 points)* Calculate $E[S]$, $E[X]$ and $E[XS]$ where the random variable $S$ is the number of the side which turns up on the die. Are $X$ and $S$ orthogonal, uncorrelated, independent?