



Sharif University of Technology

Stochastic Processes

Fall 2025

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Quiz 1 (15 minutes)

Probability Concepts - Review

Date: Oct. 21th

1. (a) Define **independence** and **uncorrelatedness** for two random variables, X and Y , each in a single sentence, and provide their corresponding mathematical formulas (**15 pts**).
(b) Let X be a random variable with a uniform distribution, $X \sim U(a, b)$, and let $Y = X^2$. Are X and Y independent? Under what condition will X and Y be **uncorrelated**? Justify your answer (**25 pts**).

2. A random variable Y has a mean $\mu_Y = 50$ and a variance $\sigma_Y^2 = 25$. Find an upper bound for the probability that Y deviates from its mean by more than 15, i.e., find an upper bound for $P(|Y - 50| \geq 15)$ (**20 pts**).

3. Imagine a meteorologist states, "**There is a 70% probability of rain tomorrow.**" How would a strict **Frequentist** and a strict **Bayesian** interpret this statement differently? What does the "70%" refer to in each philosophy? (**20 pts**)

4. Consider the function $F_X(x) = \frac{x^2}{1+x^2}$. Does this function qualify as a valid CDF? Justify your answer by checking all necessary properties (4 Properties) (**20 pts**).