

Name:  
Roll Number:  
Department:  
Program: BTech / MTech TA / MTech RA / PhD (Tick one)



## AI5030: PROBABILITY AND STOCHASTIC PROCESSES

### QUIZ 7

DATE: 18 NOVEMBER 2024

Question	1	2	Total
Marks Scored			

#### Instructions:

- Fill in your name and roll number on each of the pages.
- You may use any result covered in class directly without proving it.
- Unless explicitly stated in the question, DO NOT use any result from the homework without proof.

Fix a probability space  $(\Omega, \mathcal{F}, \mathbb{P})$ .

Assume that all random variables appearing in the questions below are defined with respect to  $\mathcal{F}$ .

#### 1. (2 Marks)

Fix  $n \in \mathbb{N}$ . Let  $X$  have the characteristic function

$$C_X(s) = \cos\left(\frac{s}{2^n}\right), \quad s \in \mathbb{R}.$$

Determine the distribution of  $X$ .

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2. (3 Marks)

Let  $X, Y$  be random variables with means, variances, and moment generating functions  $\mathbb{E}[X], \mathbb{E}[Y], \text{Var}(X), \text{Var}(Y)$ , and  $M_X, M_Y$  respectively. Determine the mean, variance and moment generating function of random variables  $A, B, C$ , whose moment generating functions are defined below.

- (a)  $M_A(t) = (M_X(t))^5$  for all  $t \in \mathbb{R}$ .
- (b)  $M_B(t) = e^{6t} M_X(5t)$  for all  $t \in \mathbb{R}$ .
- (c)  $M_C(t) = (M_X(t))^6 (M_Y(t))^5$  for all  $t \in \mathbb{R}$ .