Simulation Lab(MC503)

Assignment-5

Try to solve all the problems

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1. Generate sample from Lindley distribution using probability integral transformation with CDF as

$$F_x(x;\theta) = 1 - \frac{\theta + 1 + \theta x}{\theta + 1} e^{-\theta x}, \; x > 0, \; \theta > 0.$$

2. Generate 1000 samples for the following distributions with the given PDF as:

i) Chauchy Distribution

$$f_X(x;\alpha) = \frac{1}{\pi}\left[\frac{\alpha}{x^2 + \alpha^2}\right], \; x \in \mathcal{R}, \; \alpha > 0.$$

ii) Generalized exponential distribution

$$f_X(x;\alpha,\beta) = \alpha\beta e^{-\beta x}\left(1 - e^{-\beta x}\right)^{\alpha - 1}, \; x > 0, \; \alpha, \beta > 0.$$

iii) Kumaraswamy Distribution

$$f_X(x;\alpha,\beta) = \alpha\beta x^{\alpha-1}(1 - x^\alpha)^{\beta-1}, \; x \in (0,1), \; \alpha, \beta > 0.$$

* Here, first find the CDF of distribution, then apply probability integral transformation to generate the samples. To verify whether the generated sample is correct if the mean of generated samples is approximately equal to the mean of the distribution.

3. If $f(x) = a + 2(1-a)x, \; 0 \le x \le 1; = 0$, otherwise. Generate 2000 samples from this distribution using the Probability Integral Transform method, if possible (taking a specific value of the parameter a). If not, use the following method:

$$\begin{aligned} &\text{Generate } U_1, \; U_2, \; U_3 \sim U(0,1) \\ &\text{If } U_1 \le a, \; X = U_2 \\ &\text{Else, } \{X = \max(U_2, U_3)\} \end{aligned}$$

4. Generate 1000 standard normal random samples using the following algorithm.

Step-I: Generate $U_1, U_2 \sim U(0,1)$. Let $V_i = 2U_i - 1, \; i = 1, 2, \; W = V_1^2 + V_2^2$. If $W > 1$, freshly start step I.

Step-II: Let $Y = \left(-\frac{2\ln W}{W}\right)^{(1/2)}$ and $X_1 = V_1 Y, X_2 = V_2 Y$.

Then $(X_1, X_2) \sim N(0,1)$.

. . . . end . . . .