CSL003P1M: Probability and Statistics
Semester-1: 2024-2025
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Assignment-4 (Convergence in probability, WLLN)

Notation: $\overline{X}_n = \frac{1}{n}\sum_{i=1}^{n} X_i$.

1. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow uniform distribution $U(a, b)$. Without using Khintchine's weak law of large numbers (WLLN), find c such that $\overline{X}_n \xrightarrow{P} c$ as $n \to \infty$.
2. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow uniform distribution $U(a, b)$, and $\overline{X}_n \xrightarrow{P} 0$ as $n \to \infty$. Find the relation between a and b.
3. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow uniform distribution $U(-2, b)$, and $\overline{X}_n \xrightarrow{P} 0$ as $n \to \infty$. Find b.
4. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow uniform distribution $U(-2, b)$, and $\overline{X}_n \xrightarrow{P} 1$ as $n \to \infty$. Find b.
5. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow uniform distribution $U(a, 1)$, and $\overline{X}_n \xrightarrow{P} 0$ as $n \to \infty$. Find a.
6. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow normal distribution $N(0, 1)$. Without using Khintchine's WLLN, find c such that $\overline{X}_n \xrightarrow{P} c$ as $n \to \infty$.
7. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow normal distribution $N(\mu, \sigma^2)$, and $\overline{X}_n \xrightarrow{P} 0$ as $n \to \infty$. Find μ.
8. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow normal distribution $N(\mu, \sigma^2)$, and $\overline{X}_n \xrightarrow{P} 5$ as $n \to \infty$. Find μ.
9. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow binomial distribution $Bin(2, \frac{1}{2})$. Without using Khintchine's WLLN, find c such that $\overline{X}_n \xrightarrow{P} c$ as $n \to \infty$.
10. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow binomial distribution $Bin(a, \frac{1}{2})$, and $\overline{X}_n \xrightarrow{P} 3$ as $n \to \infty$. Find a.
11. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow binomial distribution $Bin(a, \frac{1}{3})$, and $\overline{X}_n \xrightarrow{P} 5$ as $n \to \infty$. Find a.
12. Let $X_1, X_2, \ldots, X_n$ be i.i.d and follow binomial distribution $Bin(10, p)$, and $\overline{X}_n \xrightarrow{P} 2$ as $n \to \infty$. Find p.

*** All the best ***