13. Exercise: Convergence in probability

Exercises due May 1, 2020 05:29 IST *Completed*

Exercise: Convergence in probability

3/3 points (graded)

a) Suppose that X_n is an exponential random variable with parameter $\lambda = n$. Does the sequence $\{X_n\}$ converge in probability?

Yes ✔ **Answer:** Yes

b) Suppose that X_n is an exponential random variable with parameter $\lambda = 1/n$. Does the sequence $\{X_n\}$ converge in probability?

No ✔ **Answer:** No

c) Suppose that the random variables in the sequence $\{X_n\}$ are independent, and that the sequence converges to some number a, in probability. Let $\{Y_n\}$ be another sequence of random variables that are dependent, but where each Y_n has the same distribution (CDF) as X_n. Is it necessarily true that the sequence $\{Y_n\}$ converges to a in probability?

Yes ✔ **Answer:** Yes

Solution:

a) In the first case, for any $\epsilon > 0$, we have $\mathbf{P}\left(X_n \geq \epsilon\right) = e^{-n\epsilon}$, which converges to zero. Therefore, we have convergence in probability.

b) In the second case, for any $\epsilon > 0$, we have $\mathbf{P}\left(X_n \geq \epsilon\right) = e^{-\epsilon/n}$, which converges to one. Therefore, we do not have convergence in probability.

c) Dependence will not make a difference because the definition of convergence in probability involves probabilities of the form $\mathbf{P}\left(|Y_n - a| \geq \epsilon\right)$. These probabilities are completely determined by the marginal distributions of the random variables Y_n, and these marginal distributions are the same as for the sequence X_n.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

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Topic: Unit 8: Limit theorems and classical statistics:Lec. 18: Inequalities, convergence, and the Weak Law of Large Numbers / 13. Exercise: Convergence in probability

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- Ex. - Convergence in Probability — 5
  In this Ex. , the limit a=0 . Does this imply that the PDF is max at zero. Is my conclusion right ? One of the ...
- Ex. - Convergence in Probability - c — 2
  The solution in part (c) : 1) " Dependence will not make a difference because the definition of convergenc...
- Does convergence always means convergence to zero — 8
  For (b), since it converges to 1, I had entered an answer that it is true. However, this was marked wrong. ...
- Didn't quite get the first part — 3
  I didn't understand how exponential converges to 0. When does exponential function ever converge to 0 ?
- Question B. Convergence in probability — 2
- Questions a) and b): no information about PDF of rv, how can we conclude about convergence in probability? — 5
  In questions a) and b) it only describes some random variables, but it does not explicitly state that their ...
- Part C — 4
  Just wondering where the below is mentioned in the lecture, or if someone can help me understand it us...
- Visualisation of the expenontial distributions in question — 3
  Maybe some of you find this helpful https://www.geogebra.org/graphing/uryyvafh
- Hint: Question a, b, and c
  A & B. Sequence of n random variables `{X1,X2,X3...Xn}. Each random variable is exponential in nature. S

💬	Bit confused about notation	5
💬	The answer for b is incomplete It should calculate the limit of P(|Xn - k| > ϵ) for any k and ϵ as n -> infinity, but it only calculates that limi...	2
💬	Part B .. I got part B wrong as I assume Probability = Lambda * exp(-lambda*x). Not sure if this is correct way of l...	8
?	should a) and b) clarify that the convergence in probability is to a = zero? I am not sure if the answer is same same for any "a", but the answer only shows the proof for the case a ...	3