14. Exercise: A variation on merging

Exercises due May 13, 2020 05:29 IST *Completed*

Exercise: A variation on merging

2/2 points (graded)

We start with two independent Bernoulli processes, X_n and Y_n, with parameters p and q, respectively. We form a new process Z_n by recording an arrival in a given time slot if and only if **both** of the original processes record an arrival in that same time slot. Mathematically, $Z_n = X_n Y_n$.

The new process Z_n is also Bernoulli with parameter p*q ✔

Answer: p*q

(Enter an algebraic function of p and q using standard notation.)

Suppose that the two Bernoulli processes X_n and Y_n are dependent. We still assume, however, that the pairs (X_n, Y_n) are independent. E.g., (X_1, Y_1) is independent from (X_2, Y_2), etc. Is the process Z_n guaranteed to be Bernoulli?

No ✔ **Answer:** No

STANDARD NOTATION

Solution:

The merged process records an arrival if and only if both of the original processes record an arrival, which happens with probability pq.

In the second case, since the pairs (X_n, Y_n) are independent, the random variables Z_n are also independent. However, there is nothing in the statement that would ensure that the Z_n are identically distributed. Thus, Z_n is not guaranteed to be a Bernoulli process. For

example, consider the special case of $p = q$ and suppose that $Y_1 = X_1$ but Y_n is independent of X_n for $n > 1$. Then $\mathbf{P}(Z_1 = 1) = p$ while $\mathbf{P}(Z_n = 1) = p^2$ for $n > 1$, violating the time-homogeneity property of Bernoulli processes.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

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? Part 2
lets say, special case where p = q, and Xi = Yi for all values of i. But as in the question all Xi are independe... 4 new

Hint: The dependency relations may be different 8 new 22

? Counter example to part (b) 3

? Bernoulli process conditions? 6

? some lameness 1 new 4