



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



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?



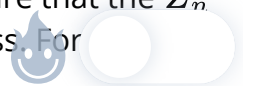
✓ Answer: No

[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.

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You have used 1 of 1 attempt

i Answers are displayed within the problem

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? Part 2

lets say, special case where $p = q$, and $X_i = Y_i$ for all values of i . But as in the question all X_i are indepe...

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

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