

STEP II, 2017, Q12

- 12 Adam and Eve are catching fish. The number of fish, X , that Adam catches in a fixed time interval T has a Poisson distribution with parameter λ . The number of fish, Y , that Eve catches in the same time interval has a Poisson distribution with parameter μ . The two Poisson variables are independent.
- (i) By considering $P(X + Y = r)$, show that the total number of fish caught by Adam and Eve in time T also has a Poisson distribution.
 - (ii) Given that Adam and Eve catch a total of k fish in time T , where k is fixed, show that the number caught by Adam has a binomial distribution.
 - (iii) Given that Adam and Eve start fishing at the same time, find the probability that the first fish is caught by Adam.
 - (iv) You are now given that, for a Poisson distribution with parameter θ , the expected time from any starting point until the next event is θ^{-1} .
Find the expected time from the moment Adam and Eve start fishing until they have each caught at least one fish.



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