

Solution for exercise 2.4.10 in Pitman

The probability of the event that there is at least one success can be calculated using the Binomial distribution. The probability of the complementary event that there is no successes in n trials can be evaluated by the Poisson approximation.

$$P(0) = e^{-\frac{1}{N} \frac{2}{3} N} = 0.5134$$

Similarly for $n = \frac{5}{3}N$

$$P(0) + P(1) = e^{-\frac{1}{N} \frac{5}{3} N} \left(1 + \frac{5}{3} \right) = 0.5037$$