

## STEP II, 1998, Q14

- 14 The staff of Catastrophe College are paid a salary of  $A$  pounds per year. With a Teaching Assessment Exercise impending it is decided to try to lower the student failure rate by offering each lecturer an alternative salary of  $B/(1 + X)$  pounds, where  $X$  is the number of his or her students who fail the end of year examination. Dr Doom has  $N$  students, each with independent probability  $p$  of failure. Show that she should accept the new salary scheme if

$$A(N + 1)p < B(1 - (1 - p)^{N+1}).$$

Under what circumstances could  $X$ , for Dr Doom, be modelled by a Poisson random variable? What would Dr Doom's expected salary be under this model?



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