MATH4/68181: EXTREME VALUES AND FINANCIAL RISK
SEMESTER 1
QUIZ PROBLEM 4
(Deadline: Tuesday 19 November 2019, 12:00noon)

Suppose a company has N systems functioning independently at a given time, where N is a geometric random variable with the probability mass function

$$\Pr(N = n) = (1 - p)p^{n-1}$$

for $n = 1, 2, \ldots$. Suppose too that each system is made of α parallel units, so the system will fail if all of the units fail. Assume that the failure times of the units for the ith system, say $Z_{i,1}, Z_{i,2}, \ldots, Z_{i,\alpha}$, are independent and identical exponential random variables with probability density function $\beta \exp(-\beta z)$, $z > 0$. Let Y_i denote the failure time of ith system. Let X denote the time to failure of the first out of the N functioning systems. We can write $X = \min(Y_1, Y_2, \ldots, Y_N)$. Calculate $\text{VaR}_q(X)$, $0 < q < 1$.

This problem is worth 2 marks. Marking scheme: 2 marks if the answer is correct, and the derivation is correct and detailed enough; 1 mark if the answer is correct, and the derivation is incorrect or not detailed enough; 1 mark if the answer is incorrect or not given, but the derivation is correct and detailed enough; 0 mark if the answer is correct, but the derivation is not detailed enough; 0 mark if the answer is incorrect, and the derivation is not detailed enough.

You can give your written solution to me during any of the lectures or example classes. You can also bring your solution to ATB2.223, place it under the door if I am not in. Email submissions or late submissions will not be accepted. I will mark your solutions and email your mark, feedback and scanned work to you within 24 hours of the deadline. PLEASE DO NOT FORGET TO WRITE YOUR FULL NAME AND ID.