



## **STEP II, 2001, Q13**

- 13** The life times of a large batch of electric light bulbs are independently and identically distributed. The probability that the life time,  $T$  hours, of a given light bulb is greater than  $t$  hours is given by

$$P(T > t) = \frac{1}{(1 + kt)^\alpha},$$

where  $\alpha$  and  $k$  are constants, and  $\alpha > 1$ . Find the median  $M$  and the mean  $m$  of  $T$  in terms of  $\alpha$  and  $k$ .

Nine randomly selected bulbs are switched on simultaneously and are left until all have failed. The fifth failure occurs at 1000 hours and the mean life time of all the bulbs is found to be 2400 hours. Show that  $\alpha \approx 2$  and find the approximate value of  $k$ . Hence estimate the probability that, if a randomly selected bulb is found to last  $M$  hours, it will last a further  $m - M$  hours.



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