

## **STEP II, 2006, Q13**

- 13** I know that ice-creams come in  $n$  different sizes, but I don't know what the sizes are. I am offered one of each in succession, in random order. I am certainly going to choose one — the bigger the better — but I am not allowed more than one. My strategy is to reject the first ice-cream I am offered and choose the first one thereafter that is bigger than the first one I was offered; if the first ice-cream offered is in fact the biggest one, then I have to put up with the last one, however small.

Let  $P_n(k)$  be the probability that I choose the  $k$ th biggest ice-cream, where  $k = 1$  is the biggest and  $k = n$  is the smallest.

- (i) Show that  $P_4(1) = \frac{11}{24}$  and find  $P_4(2)$ ,  $P_4(3)$  and  $P_4(4)$ .
- (ii) Find an expression for  $P_n(1)$ .



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