

STEP II, 2016, Q13

- 13 (i) The random variable X has a binomial distribution with parameters n and p , where $n = 16$ and $p = \frac{1}{2}$. Show, using an approximation in terms of the standard normal density function $\frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$, that

$$P(X = 8) \approx \frac{1}{2\sqrt{2\pi}}.$$

- (ii) By considering a binomial distribution with parameters $2n$ and $\frac{1}{2}$, show that

$$(2n)! \approx \frac{2^{2n} (n!)^2}{\sqrt{n\pi}}.$$

- (iii) By considering a Poisson distribution with parameter n , show that

$$n! \approx \sqrt{2\pi n} e^{-n} n^n.$$



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