

Expectation Extension Sheet

In the last prep you were asked to solve:

9. "Three dice are rolled and the smallest value, X , recorded. Calculate
- (a) $\mathbb{E}(X)$.
 - (b) $\mathbb{E}(X^2)$.
 - (c) $\mathbb{E}(X^2) - (\mathbb{E}(X))^2$."

Consider the following extensions:

1. n dice are rolled and the smallest value, X , recorded.
- (a) Calculate the expectation of X and give your result in as simple form as possible.
 $\frac{1+2^n+3^n+4^n+5^n+6^n}{6^n}$
 - (b) Why does your function have the properties required as $n \rightarrow \infty$? tends to one
 - (c) Calculate and simplify the variance of X .
 - (d) What happens to the variance as $n \rightarrow \infty$? tends to zero
2. A superdie has s faces labelled $1, 2, 3, \dots, s$.
 n superdice are rolled and the smallest value, X , recorded.
- (a) Calculate the expectation of X and give your result in as simple form as possible.
 - (b) Why does your function have the properties required as $n \rightarrow \infty$?
 - (c) Calculate and simplify the variance of X .
 - (d) What happens to the variance as $n \rightarrow \infty$?