

1 Economics 6818 Review Questions Set 2

1. Assume that x and y are both continuous random variables. Derive $var(x + y)$ as a function of $var(x)$, $var(y)$, and $cov(x, y)$. How does this simplify if x and y are independent?

2. Demonstrate that the following two statements are not, in general, true

$$E[xy] = E[x]E[y]$$

and

$$E[x/y] = \frac{E[x]}{E[y]}$$

Is there a set of more restrictive conditions under which they are always true?

3. Consider conditional expectations. Assume some joint density function $f(x, y)$, and some function of x and y , $g(x, y)$. Assume both x and y are continuous random variables. What is?

$$E[g(x, y) : X = x]$$

4. Why is *expected value* a misleading name for $E[x]$
5. If x is a random variable with $var(x) = \sigma_x^2$, what is the variance of ax , where a is some parameter. What if $a = \frac{1}{n}$?
6. Demonstrate, with an example that, in general

$$E[g(x)] \neq g(E[x])$$

7. $E[g(x)]$ has certain well-known properties that are very useful in econometrics. Let c and c_i denote constants. What is

$$E[c] =$$

$$E[cg(x)] =$$

$$E[c_1g_1(x) + c_2g_2(x)] =$$

8. What is the relationship between $E[g_1(x)]$ and $E[g_2(x)]$ if $g_1(x) \leq g_2(x) \forall x$.
9. Can you prove that

$$\begin{aligned} var[X] &= E[(X - E[x])^2] \\ &= E[X^2] - (E[X])^2 \end{aligned}$$

if $E[X^2]$ exists. If true this formula gives us two ways to calculate a variance. This might come in handy.