

**ECE 313****In-Class Activity 3**

Write your name and UID here:

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**Q1.** Let  $U$  be a discrete random variable taking the values  $a_1, \dots, a_r$  with probabilities  $p_1, \dots, p_r$ .

- a) Suppose all  $a_i \geq 0$ , but that  $E(U) = 0$ . Show then  $P(U = 0) = 1$ .
- b) Suppose that  $V$  is a random variable taking the values  $b_1, \dots, b_r$  with probabilities  $p_1, \dots, p_r$ . Show that  $Var(V) = 0$  implies  $P(V = E(V)) = 1$ .

**Q2.** In models for the lifetimes of mechanical components one sometimes uses random variables with distribution functions from the so-called Weibull family. Here is an example:  $F(x) = 0$  for  $x < 0$ , and  $F(x) = 1 - \exp(-5x^2)$  for  $x \geq 0$ . Construct a random variable  $X$  with this distribution from a  $U(0,1)$  random variable.

**Q3.** We have learned how to generate  $Y \sim \text{Exp}(\lambda)$  from  $X \sim U(0,1)$ . We obtain  $Z$  from  $Y$  by rounding to the nearest integer greater than  $Y$ . What is the distribution of  $Z$ ?

**Q4.** Let  $X$  be a continuous random variable. Express the distribution function and probability density of the random variable  $Y = -X$  and  $Z = 1/X$  in terms of those of  $X$ .