# ASSIGNMENT 1 - MAS291

1. An inspector working for a manufacturing company has a 99% chance of correctly identifying defective items and a 0.5% chance of incorrectly classifying a good item as defective. The company has evidence that its line produces 0.9% of nonconforming items.

   (a) What is the probability that an item selected for inspection is classified as defective?

   (b) If an item selected at random is classified as nondefective, what is the probability that it is indeed good?

2. The following circuit operates if and only if there is a path of functional devices from left to right. Assume devices fail independently and that the probability of failure of each device is as shown. What is the probability that the circuit operates?
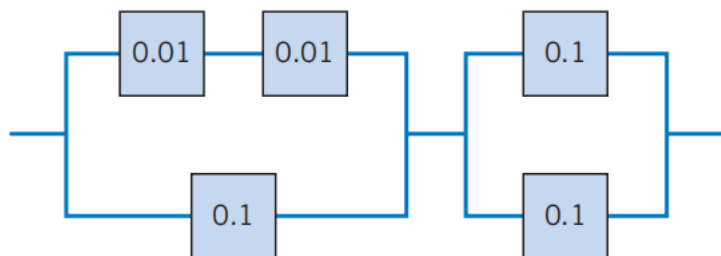
3. A player of a video game is confronted with a series of opponents and has an 80% probability of defeating each one. Success with any opponent is independent of previous encounters. The player continues to contest opponents until defeated.

   (a) What is the probability mass function of the number of opponents contested in a game?

   (b) What is the probability that a player defeats at least two opponents in a game?

   (c) What is the expected number of opponents contested in a game?

   (d) What is the probability that a player contests four or more opponents in a game?

   (e) What is the expected number of game plays until a player contests four or more opponents?

4. A state runs a lottery in which six numbers are randomly selected from 40, without replacement. A player chooses six numbers before the state's sample is selected.

   (a) What is the probability that the six numbers chosen by a player match all six numbers in the state's sample?

   (b) What is the probability that five of the six numbers chosen by a player appear in the state's sample?

   (c) What is the probability that four of the six numbers chosen by a player appear in the state's sample?

   (d) If a player enters one lottery each week, what is the expected number of weeks until a player matches all six numbers in the state's sample?

5. Let A be the largest digit in your ID. Find the number c such that the function $f(x) = cx$ is the probability mass function of some discrete random variable $X = \{0, 1, 2, A\}$. For this random variable X, answer the following questions:

   (a) Describe the probability distribution of X.

   (b) Let $F(x)$ be the cumulative distribution function of X. Find a formula for $F(x)$, where x is an arbitrary real number.

   (c) Graph the function $y = F(x)$.