Probability Activity II

1) Eliza and Dani are producing Wubble Bubbles, and each one has a probability of 0.03 of being defective (puncturing when played with). The bubbles are packaged in boxes of 20. Assume that the defects occur independently from bubble to bubble.

   (a) Define the random variable X as the number of defective bubbles in a box of 20 bubbles. Identify the distribution of X, including its parameters.

   (b) Calculate the probability that exactly 2 bubbles in a box of 20 are defective.

   (c) Calculate the probability that at least one bulb in a box of 20 is defective.

   (d) A quality control manager decides that if a box contains 3 or more defective bubbles, it will be rejected. Calculate the probability that a randomly selected box will be rejected.

   (e) A company buys 50 boxes of these Wubble bubbles. Estimate the expected number of boxes that will be rejected based on the probability calculated in part (d).

2) The Wubble bubbles are such a hit that Eliza and Dani have to start using two different production lines to keep up, Line E (with Eliza in charge) and Line D (with Dani in charge). The probability that a randomly selected bubble from Line E is defective is 0.04, while the probability that a randomly selected bubble from Line D is defective is 0.02. Their company produces 60% of its bubbles on Line E and 40% on Line D.

(a) What is the probability that a randomly selected bubble is produced on Line E and is defective? Show your work and use the multiplication rule.

(b) What is the probability that a randomly selected bubble is defective? Use the law of total probability in your calculations.

(c) Given that a randomly selected bubble is defective, what is the probability that it was produced on Line E? Show your calculations.

(d) Are the events "being produced on Line E" and "being defective" independent? Justify your answer mathematically using the definition of independent events.