

What do the following sampling scenarios have in common?

1. According to a market research firm, 52% of all residential telephone numbers in Los Angeles are unlisted. A telephone sales firm uses random digit dialing equipment that dials residential numbers at random, regardless of whether or not they are listed in the telephone directory. The firm calls 500 numbers in Los Angeles. What are the chances that at least half the numbers called are unlisted?
2. An opinion poll asks a sample of 200 adults whether they favor giving parents of school-age children vouchers that can be exchanged for education at any public or private school of their choice. Each school would be paid by the government on the basis of how many vouchers it collected. Suppose in fact that 45% of the population favors this idea. What is the probability that the sample indicates that a majority of the population favors the idea?
3. A production process is known to historically produce 6% defectives in the manufacture of an electronic component. In quality control, produced items are periodically sampled off of the production line to assess the status of the process. Suppose that a random sample of 20 items are pulled off the line for inspection, and that 3 of them are defective. Can you confidently conclude that the process is out of control?
4. A strand of 50 Christmas tree lights is wired in series, so that if one light fails, the entire strand fails. Each light has a probability of 0.02 of failing in a 3 year period. Individual lights fail independently of each other. What is the probability that the strand fails in the next three years? If you need 100 Christmas tree lights, is it smarter to buy two 50-light strands or one 100-light strand?
5. You are taking a 10 question multiple-choice test, where for each question you must choose one of three possible choices. 70% is the minimum passing grade (i.e., getting at least 7 of the 10 questions correct). If you randomly guess at each of the questions, what is the chance you pass?