

# Assignment 1-probability and Random Variable

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**Problem Statement:** Suppose that 90% of people are right handed. What is the probability that at most 6 of a random sample of 10 are right-handed?

**Solution:** Let  $X$  be the number of right-handed people  
 $n=10$ (number of sample)  
 $p=9/10$ (probability of right handed people)  
 $q=1/10$ (probability of left handed people)

$$\begin{aligned}P(X \leq 6) &= 1 - P(X > 6) \\&= 1 - [P(X = 7) + P(X = 8) + P(X = 9) + P(X = 10)] \\&= 1 - \left[ {}^{10}C_7 \left(\frac{9}{10}\right)^7 \left(\frac{1}{10}\right)^3 + {}^{10}C_8 \left(\frac{9}{10}\right)^8 \left(\frac{1}{10}\right)^2 \right. \\&\quad \left. + {}^{10}C_9 \left(\frac{9}{10}\right)^9 \left(\frac{1}{10}\right) + {}^{10}C_{10} \left(\frac{9}{10}\right)^{10} \right] \\&= 1 - 9^7/10^{10} [{}^{10}C_7 + {}^{10}C_8 \times 9 + {}^{10}C_9 \times 9^2 + {}^{10}C_{10} \times 9^3] \\&= 1 - 9^7/10^{10} \left[ \frac{10 \times 9 \times 8}{3 \times 2 \times 1} + \frac{10 \times 9 \times 9}{2} + 10 \times 81 + 729 \right] \\&= 1 - 9^7/10^{10} [120 + 405 + 810 + 729] \\&= 1 - \left( \frac{9^7 * 2064}{10^{10}} \right)\end{aligned}$$

(1)