

1. Suppose you play the game of shooting. You shoot 6 times, each time to a different enemy, and each shot has a 10% chance of success.

1) What's the probability of killing two enemies out of six?

P1

$$p^k(1-p)^{n-k} \leftarrow \text{Formula}$$

part 2

$$0.1^2(1-0.1)^{6-2} = 0.006561$$

part 2

$$\frac{n!}{k!(n-k)!} = \frac{6!}{2!(4!)} = \frac{720}{48} = 15$$

$$15 \times 0.006561 = 0.098415 \times 100 = 9.84\%$$

2) What's the probability of killing at most three enemies out of six?

P2

$$p^k(1-p)^{n-k}$$

part 1

$$0.1^1(1-0.1)^{6-1} = 0.059$$

part 2

$$\frac{n!}{k!(n-k)!} = \frac{6!}{1!(6-1)!} = \frac{720}{120} = 6$$

$$6 \times 0.059 = 0.354 \times 100 = 35.4\%$$

$$0.1^3(1-0.1)^{6-3} = 0.000729$$

$$\frac{6!}{3!(6-3)!} = \frac{720}{36} = 20 \times 0.000729 = 0.01458$$

$$0.01458 \times 100 = 1.45\%$$

$$\text{Ans} = 9.84 + 35.4 + 1.45 = 46.69\%$$

3) What's the maximum number of enemies we can kill with 90% probability?

Answer: We can kill 1 enemy

P3

$$90\% = 0.1^k(1-0.1)^{6-k}$$

$$x > \log(0.1) / \log(0.90) = 21.85$$

$$x = \log_e(21.85)$$

$$x = 1.7213 \approx \text{only 1 enemy}$$

2. Suppose there is only one enemy and two success shots can kill the enemy. Each shot has a 10% chance of success. How many times do you need to shoot to kill the enemy with 80% probability?

$$P(X=x) = \binom{n}{x} (0.1)^x (0.9)^{n-x}$$

$$1 - P(x=0) > 0.8$$

$$1 - \binom{n}{0} (0.1)^0 (0.9)^{n-0} > 0.8$$

$$1 - (0.9)^n > 0.8$$

$$0.2 > (0.9)^n$$

Solving using logarithms

$$\log(0.2) > \log(0.9)^n$$

$$\log(0.2) > n \log(0.9)$$

$$\frac{\log(0.2)}{\log(0.9)} > n$$

↑
negative

$$n = \frac{\log(0.2)}{\log(0.9)} \approx 15.27 \quad \text{Ans 15}$$