

1. Suppose an antibiotic has been shown to be 70% effective against a common bacteria.
 - a) If the antibiotic is given to five unrelated individuals with the bacteria, what is the probability that it will be effective in exactly three?
 - b) What is the probability that the antibiotic is effective in exactly three patients out of five (when the probability of effectiveness in a single patient is 70%).
 - c) What is the probability that the antibiotic will be effective in none of the five?

Use this formula: $P_n(k) = C_n^k p^k q^{n-k}$, where $q=1-p$.

- a) We are using **five** unrelated individuals, so $n=5$,
 We should find the probability that it will be effective in exactly **three**, so $k=3$,
 probability of success is **70%**, or $p = \frac{70}{100} = 0.7$,
 Probability of failure is $q=1-p=1-0.7=0.3$

$$P_5(3) = C_5^3 0.7^3 0.3^2 = \frac{5!}{3!2!} 0.7^3 0.3^2 = 0.3087$$
- b) (the same with task (a), but instead of individuals of bacteria using the patients)
 $n=5, k=3, p=0.7$, so $P_5(3) = C_5^3 0.7^3 0.3^2 = \frac{5!}{3!2!} 0.7^3 0.3^2 = 0.3087$
- c) We should find the probability that it will be effective in **none**($k=0$) of the **five**($n=5$)
 probability of success is **70%**, or $p = \frac{70}{100} = 0.7$,
 Probability of failure is $q=1-p=1-0.7=0.3$
 $n=5, k=0, p=0.7$, so $P_5(0) = C_5^0 0.7^0 0.3^5 = \frac{5!}{0!5!} 0.7^0 0.3^5 = 0.00243$