

Problem :

Your cardiologist has a surgical success rate of 75%. This doctor has 5 cardiac surgeries scheduled for the coming week. What is the likelihood that fewer than 4 of these patients will survive?

Solution :

This is a binary probability distribution problem, since a patient will either (1) survive, or (2) not survive. We just have to solve this...

$$P(x \leq 3) = {}_n C_x \cdot p^x \cdot (1-p)^{n-x}$$

Where... $n = 5$
 $p = 0.75$
 $x = 0,1,2,3$

$${}_n C_x = \frac{n!}{(x!)(n-x)!} ; \text{ for example, } {}_5 C_2 = \frac{5!}{(2!)(5-2)!} \rightarrow 10$$

$$P(x \leq 3) = P(x=0) + P(x=1) + P(x=2) + P(x=3)$$

$$P(x \leq 3) = {}_5 C_0 \cdot (0.75)^0 \cdot (0.25)^{5-0} + {}_5 C_1 \cdot (0.75)^1 \cdot (0.25)^{5-1} + \text{you do the last two}$$

$$P(x \leq 3) = (1)(1)(0.00098) + (5)(0.75)(0.00391) + (10)(0.5625)(0.01563) + (10)(0.42188)(0.0625)$$

$$P(x \leq 3) = 0.00098 + 0.01466 + 0.08792 + 0.26368$$

$$P(x \leq 3) = 0.37 \rightarrow 37\%$$

So, it's a bit over 1:3 that fewer than four patients will survive the surgery. What do you think of those odds? Satisfactory... or change surgeons?