

A manufacturer of camera flashbulbs notes that defective bulbs are sometimes produced with a probability of 0.02. If four bulbs are selected at random **a)** What is the probability that there are no defective bulbs? **b)** What is the probability that exactly one of the four bulbs is defective?

Essay Question  
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$$\begin{aligned}
 p &= 0.02 \\
 n &= 4 \text{ bulbs} \\
 q &= p^c = 1 - 0.02 \\
 &= 0.98
 \end{aligned}$$

**a)** what is the probability that there are no defective bulbs?

$$P[X \leq 0] = ??$$

$$P[X = x] = {}^n C_x p^x q^{n-x} \quad \begin{array}{l} n = 1, 2, \dots \\ x = 0, 1, 2, \dots \end{array}$$

$$\begin{aligned}
 P[X \leq 0] &= 1 - P[X > 0] \\
 &= 1 - \{P[X=1] + P[X=2] + P[X=3] + P[X=4]\} \\
 &= 1 - \left\{ {}^4 C_1 (0.02)^1 (0.98)^{4-1} \right.
 \end{aligned}$$

$$\begin{aligned}
 &+ {}^4 C_2 (0.02)^2 (0.98)^{4-2} \\
 &+ {}^4 C_3 (0.02)^3 (0.98)^{4-3} \\
 &+ {}^4 C_4 (0.02)^4 (0.98)^{4-4}
 \end{aligned}$$

$$= 1 - \{0.07529 + 0.00230 + 0.00003 + 0.00000\}$$

$$= 1 - 0.07762 = \boxed{0.92238}$$

$\boxed{0.92238}$  is the probability of no defective bulbs.

**b)**  $P[X=1] = ?$

$$P[X=1] = {}^4 C_1 (0.02)^1 (0.98)^{4-1}$$

$$P[X=1] = 0.07529$$

$\boxed{0.07529}$  is the prob. that there is exactly one of the four bulbs is defective.