① A software firm produces accounting programs. The probability that one of their programs is defective is 0.2. A chain store purchaser 20 accounting programs from that firm.

    a) Find the probability that exactly 3 programs are defective.
    b) Find the probability that at least 80% of the programs are working properly.
    c) Let x denote the number of programs that are working properly. Find the probability distribution function of X. What type of distribution is it?
    d) What is the expected number of programs that are working properly.

② $X_1, X_2, \dots X_m$ be a random sample drawn from a Poisson distribution with parameter λ, unknown (for $X \in P(\lambda)$), the pdf is $p(x, \lambda) = \dfrac{\lambda^x}{x!} e^{-\lambda}$, $x = 0, 1 \dots$,
$M(x) = M(x) = \lambda$)

    a) Find the maximum likelihood estimate, $\overline{X}$ for λ.
    b) Is it an absolutely correct estimator? Explain
    c) Find the efficiency of $\overline{X}$, $e(\overline{X})$.
    d) At the significance level $\alpha e(0, e)$, find the most powerful test
for testing $H_0: \lambda = 1$, against $H_1: \lambda = 2$

①

a)
$k = 3$
$m = 20$
$p = 0.2$ binomială

$C_{20}^3 (0.2)^3 (0.8)^{17}$

b)

80% ⇒ 16 cel puțin ⇒ 1 - 4 cel mult

$k < 4$

$k - C_{20}^{}$ $1 - \sum\limits_{i=0}^{3} C_{20}^k (0.2)^k \cdot (0.8)^{20-k}$

c)

$X \begin{pmatrix} k \\ C_{20}^k (0.2)^k (0.8)^{20-k} \end{pmatrix}_{k=0,20}$ Distr. binomială

d)

$0.2 \times 20 = 4$ se așteaptă să fie defecte

$20 - 4 = 16$ ⇒ numărul de programe care funcționează bine