A factory produces light bulbs and probability of a bulb being defective is 0.05. The factory produces large batch of 500 light bulbs.

Let $X$ be number of defective bulbs.

~~$P(X=x) = nCx\ p^x\ q^{n-x}$~~

$=$

$$P(X=x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$\lambda$ = mean $= np = 500 \times 0.05 = 25$

$$= \frac{e^{-25}\ 25^{20}}{20!}$$

b) probability that atleast 10 are defective

$$P(X \geq 10) = 1 - P(X < 10)$$

$$= 1 - P(X=0) + P(X=1) + \cdots P(X=9)$$

$$= 1 - \frac{e^{-25} 25^0}{0!} + \frac{e^{-25} 25^1}{1!} + \cdots + \frac{e^{-25} 25^9}{9!}$$

$$= 1 - e^{-25}\left[1 + 25 + \cdots \frac{25^9}{9!}\right]$$

c) probability that atmost 15 are defective.

$$P(X \leq 15) = P(X=0) + \cdots P(X=15)$$

$$= e^{-25}\left[\frac{25^0}{0!} + \frac{25^1}{1!} + \frac{25^2}{2!} + \cdots \frac{25^{15}}{15!}\right]$$

d) On a average how many would you expect to be defective in 500

$$E(X) = np$$

$$= 500 \times 0.05 = 500 \times \frac{5}{100} = 25$$

$$E(X) = 25.$$