Q.No.1: - A box of 500 rivets contains good rivets as well as rivets with defects summarized below:

i. 30 rivets with type A defect
ii. 15 rivets with type B defect
iii. 4 rivets with type A and type B defects

A rivet is chosen at random, what is the probability that it is not defective?

\[
P(\text{No defect}) = \frac{500 - 41}{500} = \frac{459}{500} = 0.918
\]

Q.No.2: - Suppose that a box contains 10% defective microchips. A purchaser decides to select 5 microchips one after another without replacement. Assume that the box has 30 microchips.

(a) What is the probability that two microchips in the sample will be defective?

\[
P(\text{2 defective microchips}) = \binom{3}{2} \binom{27}{3} \binom{30}{5} = 0.0616
\]

(b) What is the probability that the first two microchips in the sample will be defective and the last three will be good?

\[
P(DDGGG) = \frac{3}{30} \cdot \frac{2}{29} \cdot \frac{27}{28} \cdot \frac{26}{27} \cdot \frac{25}{26} = 0.0062
\]
Q.No.3: A survey of those using a particular statistical software system indicated that 10% were dissatisfied. Half of those dissatisfied purchased the system from company A. It is also known that 20% of those surveyed purchased from company A.

(a) What is probability of a satisfied customer purchasing the system from company A?

\[ \text{Solution: We have } P(D) = 0.10, \quad P(A \mid D) = 0.50, \]
\[ P(A) = 0.20. \]
\[ P(A \mid S) = \frac{P(SA)}{P(S)} , \]
\[ \text{since } P(A) = P(AD) + P(AS), \]
\[ \Rightarrow 0.20 = 0.10 \times 0.50 + P(AS), \]
\[ \Rightarrow 0.15 = 0.10 \Rightarrow P(D) = 0.15 \]
\[ P(S) = 1 - P(D) = 0.85 \]
\[ \therefore P(A \mid S) = \frac{0.15}{0.85} \approx 0.17 \]

(b) Given that the software package was purchased from company A, what is the probability that a particular user is dissatisfied?

\[ P(D \mid A) = \frac{P(DA)}{P(A)} = \frac{0.15}{0.20} \approx 0.75 \]

Q.No.4: A company claims that its chocolate chip cookies have, on the average, 16 chocolate chips in each cookie. Assume that a Poisson random variable with mean 16 is the appropriate model for the number of chips in a cookie. What is the probability that there will be 10 chips in a cookie?

Let \( X \) denotes the number of chocolate chips in a cookie.
\[ X \sim \text{Poisson} (16 \text{ per cookie}) \]
\[ P(X = x) = \frac{e^{-16}16^x}{x!} ; \quad x = 0, 1, 2, \ldots \]
\[ P(X = 10) = ??? \]
\[ = \frac{e^{-16}16^{10}}{10!} = 0.0341 \]
Specifications call for the thickness of aluminum sheets that are to be made into cans be between 8 and 11 thousandth of an inch. Let \( f(x) \) be the probability density function of \( X \).

\[
f(x) = \begin{cases} 
    cx & 6 \leq x \leq 12 \\
    0 & \text{otherwise}
\end{cases}
\]

(a) Find the value of \( c \).

\[
\int_{6}^{12} f(x) \, dx = 1 \Rightarrow \int_{6}^{12} cx \, dx = \frac{c}{2} x^2 \bigg|_{6}^{12} = 1 \Rightarrow \frac{c}{2} (144 - 36) = 1 \Rightarrow 54c = 1 \Rightarrow c = \frac{1}{54}
\]

(b) What is the probability that a sheet doesn’t meet the specification?

\[
P(\text{Does not meet specs}) = 1 - P(8 \leq X \leq 11) = 1 - \int_{8}^{11} \frac{3}{54} \, dx = \frac{3}{54} \int_{8}^{11} \frac{x}{6} \, dx
\]

\[
= \frac{3}{54} \left[ \frac{x^2}{12} \right]_{8}^{11} = \frac{3}{54} \left[ \frac{121 - 64}{12} \right] = 0.528
\]

\[
P(\text{Does not meet specs}) = 1 - 0.528 = 0.472
\]

(c) If the aluminum sheets are selected one by one, what is the probability that that 1st sheet that doesn’t meet the specification is the 4th sheet?

\[
X: \text{# trials to get the 1st sheet not meet specs}.
X: \text{Geometric}(0.472) \Rightarrow P(x) = (0.472)(0.528)^{x-1}
\]

\[
P(4^{th}) = P(X = 4) = P(4) = (0.472)(0.528)^3 = 0.069
\]

With Best Wishes