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Q.1. Let $p$ = ~~Pool~~ where person will recovers.

$\therefore$ $q$ = ~~Ewhere~~ person dies of disease = 0.75

$\therefore$ $p = 1 - 0.75 = 0.25$.

Using binomial distribution

$P(x) = {}_nC_x \, p^x q^{n-x}$.

here $n$ = no of sample = 6

$x$ = no. of +ves = 4

$\therefore P(X) = {}_6C_4 \, (0.25)^4 (0.75)^2$.

$= 15 \times 2.1973 \times 10^{-3} = 0.0329$.

$\therefore$ Probability of 4 person ~~servi~~ving is 0.0329.

(2) Since sum of P.M.f distribution is always 1

$\therefore k + 0.1 + 2k + 0.3 = 1$

$3k = 1 - 0.4$.

$k = \frac{0.6}{3} = \cancel{0.47}\ 0.2$.

$\therefore E(2) = \cancel{2 \times 0.47} = \cancel{0.94}\ 2 \times 0.2 = 0.4$.

$E(X) = \mu = \sum_{i=0}^{n} x_i \, P(x_i)$

$= 0.(0.2) + 1(0.1) + \cancel{0.4}\ 2.(0.4) + 3(0.3)$

$= 0.1 + 0.8 + 0.9$.

$= 1.8$.

$E(2x) = 2\,(E(X)) = 2 . 1.8 = 3.6$.

$V(x) = E(x - \mu)^2 = \sum_{i=0}^{n} (x_i - \mu)^2 \, P(x_i)$

$= (0 - 1.8)^2 . 0.2 + (1 - 1.8)^2 . 0.1$

$(2 - 1.8)^2 . 0.4 + (3 - 1.8)^2 . 0.3$

$= (-1.8)^2 . 0.2 + (-0.8)^2 . 0.1 + (0.2)^2 . 0.4$

$+ (1.2)^2 . 0.3$

$= (3.24) . 0.2 + (0.64)^2 \times 0.1 + (0.4) . 0.4$

$+ 1.44 . 0.3$.

$= 0.648 + 0.069 + 0.16 + 0.432 = 1.304$.

$i=0$ $i!$

here $\lambda = 4$ as 4 products are defective in a day

~~x<=2~~ $x <= 2$ since no more than 2 product needs to be defective

$\therefore F(2|4) = \frac{e^{-4} 4^0}{0!} + \frac{e^{-4} 4^1}{1!} + \frac{e^{-4} 4^2}{2!}$

$= 0 + e^{-4} 4 + e^{-4} 8$

$= 12 e^{-4} = 12 \times 0.01831$

$= 0.216.$

(4) Here we need to compare two means.

$\therefore n_1 \& n_2 = 50$

$\bar{x}_1 = 26. \quad \bar{x}_2 = 29.$

$\sigma = 10.$

$\therefore H_0 = \bar{x}_1 > \bar{x}_2$ $\qquad \alpha = 0.05$

$H_1 = \bar{x}_1 < \bar{x}_2$

$\therefore z = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{26 - 29}{\sqrt{\frac{100}{50} + \frac{100}{50}}} = \frac{-3}{\sqrt{4}} = \frac{-3}{2}$

$= -1.5$

$\therefore z_{0.05} = 1.645.$

$\therefore z_{0.05} > z$ we reject $H_0$ & accept $H_1$

$\therefore$ Carbon emission of new engines are less than old engines

⑥ Population mean ~~is~~ 10.

$n = 15$

$\bar{x} = 8.$ $\sigma = 3.$

$H_0 : \mu = \mu_0.$ $H_1 = \mu \neq \mu_0.$

∴ as sample size is less than 30 we use t test

$= t = \frac{(\bar{x} - \mu_0)}{\sigma/\sqrt{n}} = \frac{8 - 10}{3/\sqrt{15}} = \frac{-2 \times \sqrt{15}}{3} = \frac{-7.746}{3}$

$= -2.58$

degree of freedom $= n - 1 = 14.$

$\alpha = 0.05$

$\therefore t_{(0.05, 14)} = \pm 2.15$

∴ since $-2.58$ is beyond $2.15$ we reject the sellers claim of averag 10.

7. ① In simple random sampling we select the sample units randomly from the population.
In simple random sampling the sample units should have same probability of getting selected.
Since we need to select any unit from entire population sometimes SRS is cumbersome.
For e.g in case population is families in india selecting from entire country will be a costly and cumbersome.

② In stratified sampling we group the data based on some ~~group~~ property. and select sample units from each strata.
Stratified sampling is less cumbersome than SRS.

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