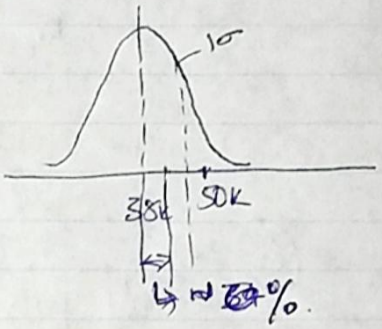
Distribution Assignment

(1) Distibution of Ages in Titanic dataset
- plotlib using Matplotlib

(2) Avg monthly sales of 2000 firms are ND with $\mu = 38000$ & $\sigma = 10,000$.



(a) # of firms with sales over 50K
→ looking at the plot ≈ 13%

$Z \Rightarrow \frac{50000 - 38000}{10000} = \frac{12}{10} = 1.2 \Rightarrow 0.8849$

Right of (>50K) $1 - 0.8849 = 0.1151 = 11.5\%$.

# of firms $\Rightarrow 11.5 \times 2000 =$ 230 firms

(b) % of Sales b/n 38500 & 41000

$Z = \frac{38500 - 38000}{10000} = \frac{5}{100} = \frac{1}{20} = 0.05 \Rightarrow 0.5199 = 0.52$

$1 - 0.52 = 48$

$Z = \frac{41000 - 38000}{10000} = \frac{3}{10} = 0.3 \Rightarrow 0.6179 \Rightarrow 1 - 0.62 = 0.38 = 38$

% of P(38500 < x < 41000) $\Rightarrow 0.6179 - 0.5199 = 0.098$
So, % of firms with sales b/n 38500 & 41000 $\Rightarrow 0.098 - 9\%$

(c) # of firms sales between 30000 & 50000
$Z = (50000 - 38000)/10000 = 12/10 = 1.2 \Rightarrow 0.8849$
$Z = (30000 - 38000)/10000 = -8/10 = -0.8 \Rightarrow 0.2199$
B/n 30K-50K $\Rightarrow 0.8849 - 0.2199 = 0.67 \Rightarrow 67\%$

# of companies $\Rightarrow 0.67 \times 2000 =$ 1340

Q3 & Q4 ⇒ Not required and are out of scope.

(5) Test with 25 MCQ. with 4 options. probability of answering exactly 5 wrong.

# of questions = 25 = n exactly 5 → r

# of options ⇒ 4 ⇒ P(correct) = 1/4 ⇒ p

P(incorrect) = 3/4 ⇒ q

prob of exactly 5 answers

$${}^{n}C_{r}\, p^{r} q^{n-r} \Rightarrow {}^{25}C_{r}\left(\frac{1}{4}\right)^{5}\left(\frac{3}{4}\right)^{25-5}$$

$$\Rightarrow {}^{25}C_{5}\left(\frac{1}{4}\right)^{5}\left(\frac{3}{4}\right)^{25-5}$$

(6) Avg rate of photons per second = 4. $\mu = 4$.

Find P() that no photon reaches in given second

$$P(x, m) = e^{-m}\frac{m^{x}}{x!} \qquad \hookrightarrow m = 4,\ x = 0$$

$$P(0, 4) \Rightarrow e^{-4} \times \frac{4^{0}}{0!} = e^{-4} \Rightarrow 0.0183$$

(7) # of calls per min into CS center is P(m) = 3

(a) no calls in given 1 min period time

$$P(0, 3) = e^{-3} \times \frac{3^{0}}{0!} = e^{-3} = 0.0498$$

(b) Assume # of calls are independent for 2 diff min. Find P() that atleast 2 calls will arrive in a given 2 min period (mean = 6)

$$P(x \geq 2) \Rightarrow 1 - P(x = 1) = 1 - P(1, 6) \Rightarrow 1 - \left\{e^{-6} \times \frac{6^{1}}{1!}\right) = 1 - (e^{-6} \times 6)$$

$$\Rightarrow 1 - 0.0148 \Rightarrow 0.9851$$

(8) prod line has 20% defective rate.
P() obtaining first defected part after 3 good parts.
What is avg of inspections to obtain first defective.

$q = 0.2 \quad p = 1-q = 1-0.2 = 0.8$

$x \Rightarrow$ # of trials.

$P(x \geq 3) = (0.8)^{3-1}$? $\Rightarrow 1 - P(x<3) = 1-(1-(0.8)^2)$

Avg (mean) inspection for 1st defect $= \frac{1}{q} = \frac{1}{0.2} = \frac{10}{2} = 5$

(9) prob that a student is accepted to a prestigious college is 0.3.
If 5 students from same school apply, what is P() that atmost 2 are accepted.

$p = 0.3 ; \quad q = 1-p = 0.7 ; \quad n = 5 \quad r \leq 2$

$b(x \leq 2 ; 5 ; 0.3) \Rightarrow {}^{n}C_r \, p^r q^{n-r}$

$\Rightarrow {}^{5}C_0 \times (0.3) \times (0.7)^{5-0} + {}^{5}C_1 \cdot (0.3)^1 \cdot (0.7)^{5-1} + {}^{5}C_2 \cdot (0.3)^2 \cdot (0.7)^{5-2}$

$\Rightarrow 0.1681 + \frac{5!}{1!(5-1)!} \times 0.3 \times (0.7)^4 + \frac{5!}{2!3!} \times (0.3)^2 + (0.7)^3$

$= 0.1681 + 5 \times 0.3 \times (0.7)^4 + 10 \cdot (0.3)^2 + (0.7)^3$
$= 0.1681 + 0.3601 + 0.3087$
$= 0.8369$

(10) Max wt. elev can adopt is 800kg. Avg Adult wt = 70kg $\sigma = 200$
P() that lift safely reaches ground when there ax 100 diff adults
Wt. of Adult = 70kg
$\Rightarrow$ Wt. of 100 Adult = 70kg x 100 = 7000kg
Elevator capacity = 800kg
Elevator will not reach the ground safely.
Well, it will reach the ground, but not the way we expect it to be. ☺

$\Rightarrow$ 12 adults $\Rightarrow 12 \times 70 = 840$kg.
Elevator can safely reach the ground.

(11) MCQ paper with two choices $n = 50$

$P(\text{success}) = \frac{1}{2}$ & $P(\text{fail}) = \frac{1}{2}$ $r \geq 20$

50 Qu. 20 to be answered correctly. $P = \frac{1}{2}$ $q = \frac{1}{2}$

What is P() that he clears the exam?

20 correct answer to pass $\Rightarrow$ $r = 20$

$$b(20, 50, 0.5) = {}^{50}C_{20} \times \left(\frac{1}{2}\right)^{20} \times \left(\frac{1}{2}\right)^{50-20}$$

If each question has 4 options: $n = 50$

$r = 20$

$$b\left(20, 50, \frac{1}{4}\right) = {}^{50}C_{20} \times \left(\frac{1}{4}\right)^{20} \times \left(1 - \frac{1}{4}\right)^{50-20} \quad P = \frac{1}{4} \quad q = \frac{3}{4}$$

(12) LED with faulty rate of 30% if I select 6 bulbs what is P() that 2 are faulty

$$b(2, 6, 0.3) = {}^{6}C_{2} \times \left(\frac{3}{10}\right)^{2} \cdot \left(\frac{7}{10}\right)^{6}$$

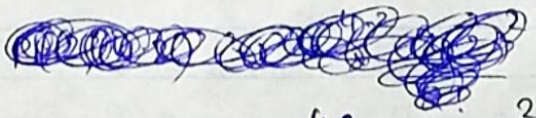
(13) efficiency of typing is 6 errors/hr with 77 words per min P() of 2 errors in 322 word report.

words per min = 77.

Time taken for 322 words $= \frac{322}{77} = 4.2$ min.

6 error per hr $\Rightarrow$ $6 \times \frac{1}{60}$ per min $\Rightarrow$ $\frac{1}{10} = 0.1$

2 errors in 322 word $\Rightarrow$



$$b(2, 4.2, 0.1) = {}^{42}C_{2} \times (0.1)^{2} \times (0.9)^{4-2}$$

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