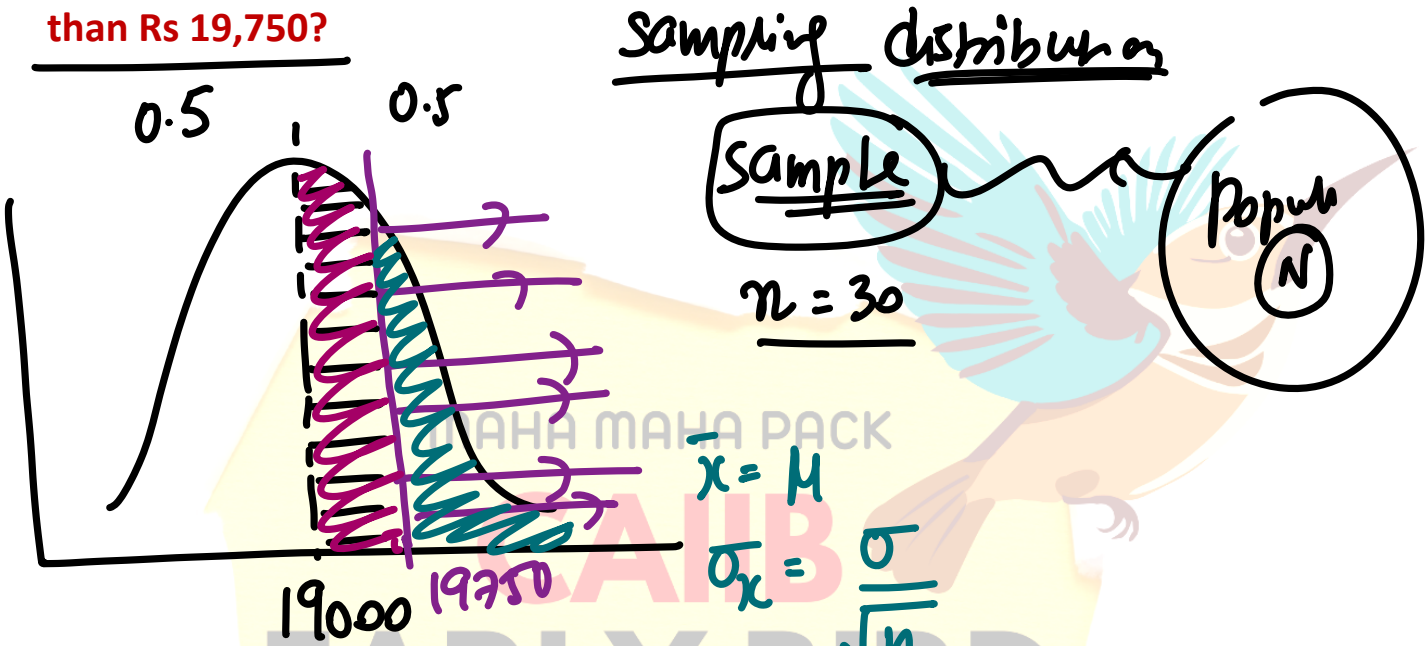
$\mu = 19000$ $\quad n = 30$

$\sigma = 2000$

CLT

CAIIB with ASHISH

Q1: Distribution of annual earnings of all bank tellers with 5 years experience is given. The Distribution has a mean of Rs 19,000 and a standard deviation of Rs 2,000. If we draw a random sample of 30 tellers, what is the probability that their earnings will average more than Rs 19,750?

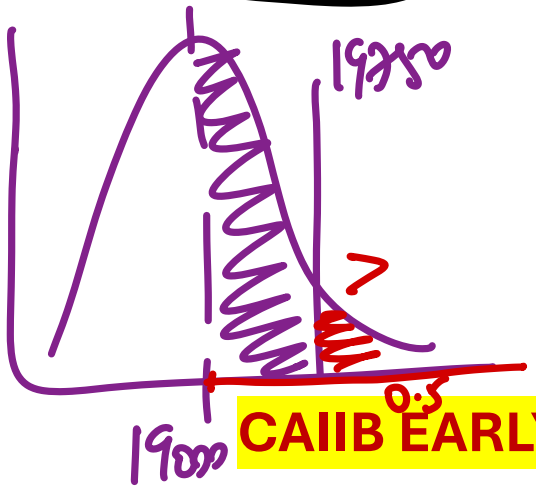


$P(\bar{x} > 19750)$

$\sigma_{\bar{x}} = \frac{2000}{\sqrt{30}} = \frac{2000}{5.47} = 365.63$

$Z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{19750 - 19000}{365.63}$ $\quad Z = 2.05$

0.4798



$0.5 - 0.4798$ → 0.0202 × 100% = 2.02%

$\mu = 112, \sigma = 56$
$n = 50$

CAIIB with ASHISH

Q2: Kamala, an auditor for a large credit company, knows that on average, the monthly balance of any given customer is Rs 112 and standard deviation is Rs 56. If she audits 50 randomly selected accounts. What is the probability that the sample average monthly balance is:

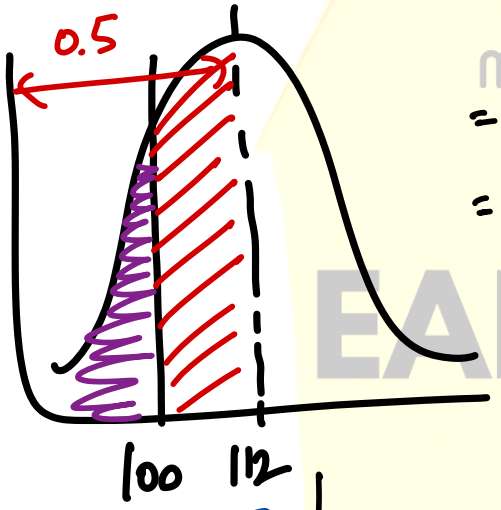
a) Below Rs 100?

b) Between Rs 100 & Rs 130?

a)

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{56}{\sqrt{50}} = 7.92$$

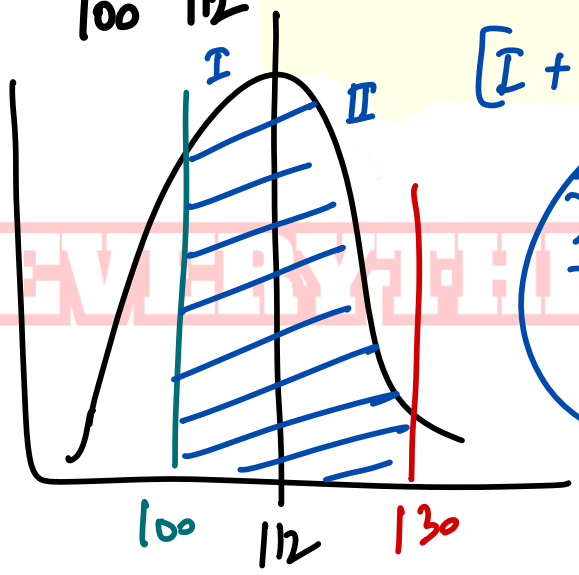
$$P(\bar{x} < 100) \Rightarrow Z = \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} = \frac{100 - 112}{7.92} = -1.51$$



$= 0.5 - 0.4345$

$= 0.0655 = \boxed{6.55\%}$

b) $P(100 < \bar{x} < 130)$



$[I + II]$ $100 \Rightarrow 0.0655$

$\frac{\bar{x} - \mu}{\sigma_{\bar{x}}}$ $\frac{130 - 112}{7.92} = 2.27$

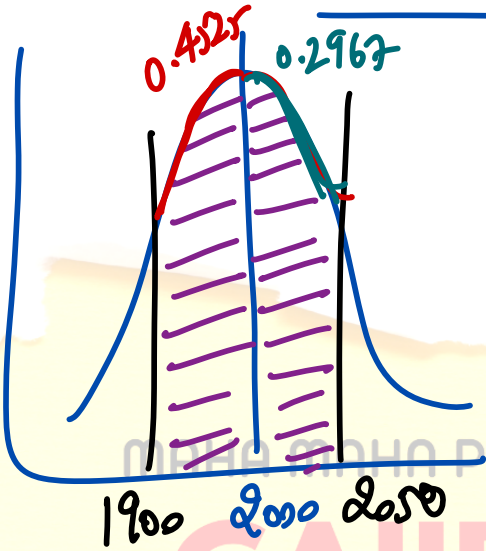
$0.4345 +$ 0.4884

$\boxed{0.9229}$ $\boxed{92.29\%}$

$\mu = 2000, \sigma = 600$
$n = 100$

CAIIB with ASHISH

Q3: A Bank calculates that its individual savings accounts are normally distributed with a mean of Rs 2000 and standard deviation of Rs 600. If the bank takes a random sample of 100 accounts, what is the probability that the sample mean will lie between Rs 1900 and Rs 2050?



$\sigma_{\bar{x}} = \frac{600}{\sqrt{100}} = 60$

$P(1900 < \bar{X} < 2050)$

$0.4525 + 0.2967$

0.7492

$\frac{\bar{x} - \mu}{\sigma_{\bar{x}}} < z < \frac{\bar{x} - \mu}{\sigma_{\bar{x}}}$

$\frac{1900 - 2000}{60} < z < \frac{2050 - 2000}{60}$

$-\frac{100}{60} < z < \frac{50}{60}$

$-1.67 < z < 0.833$

Q4: find arithmetic mean of the following:

C.I.	0-20	20-40	40-60	60-80	
Freq	5	8	10	7	Σf 30

x midpoint 10 30 50 70

fx 50 240 500 490 $\Sigma fx = 1280$

$$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{1280}{30} = 42.67$$

Q5: Find the median

C.I.	5-9	10-14	15-19	20-24	25-29
Freq	16	18	20	32	14

New C.I.	F	Less than frequency
4.5 – 9.5	16	16
9.5 – 14.5	18	34
14.5 – 19.5	20	54
19.5 – 24.5	32	86
24.5 – 29.5	14	100
	100	

$N/2 = \frac{100}{2} = 50$

$$\text{Median} = I_1 + \frac{(I_2 - I_1)\left(\frac{N}{2} - CF\right)}{F}$$

$$= 14.5 + \frac{(19.5 - 14.5)\left(\frac{100}{2} - 34\right)}{20}$$

$$= 18.5$$

Q6: Test-score distribution of 45 candidates

Score Range	Frequency
0 – 20	4
20 – 40	9
40 – 60	20
60 – 80	8
80 – 100	4

Determine the mode score.

$$\text{Mode} = i_1 + \frac{(i_2 - i_1)(f_1 - f_0)}{2f_1 - f_0 - f_2}$$

f_0, f_1, f_2

modal class (40–60)

Highest freq.

$i_2 \rightarrow 60$

$i_1 \rightarrow 40$

$f_0 \rightarrow 9$

$f_1 \rightarrow 20$

$f_2 \rightarrow 8$

$$= 40 + \frac{(60-40)(20-9)}{2\times20 - 9 - 8}$$

$$= 40 + \frac{20 \times 11}{23}$$

$$= 49.56$$

CAIIB with ASHISH

Q7: Find the Mean deviation and coefficient of mean deviation:

C.I.	10-20	20-30	30-40	40-50	50-60
Freq	16	18	20	32	14

$M.D = \frac{\sum f|x_i - \bar{x}|}{n}$; Coefficient of mean Deviation = $\frac{MD}{mean}$

C.I	f	x	fx	$\bar{x}$	$f\|x_i - \bar{x}\|$
10-20	16	15	240	36	336
20-30	18	25	450	36	198
30-40	20	35	700	36	20
40-50	32	45	1440	36	288
50-60	14	55	770	36	266
	$\sum f$ 100		$\sum fx$ 3600		1108

$\bar{x} = \frac{\sum fx}{\sum f} = \frac{3600}{100} = 36$

$MD = \frac{\sum f|x_i - \bar{x}|}{n} = \frac{1108}{100} = 11.08$

$Coff_{MD} = \frac{MD}{mean} = \frac{11.08}{36} = 30.77\%$

Q8: Find Standard Deviation and Coefficient of Variation for the following data: 4, 5, 8, 2, 3, 6.

$$\sigma = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$$

$$\text{Grouped data} = \sqrt{\frac{\Sigma f_i(x_i-\bar{x})^2}{\Sigma f}}$$

$$CoV = \frac{\sigma}{\bar{x}}$$

CAIIB with ASHISH

Q9: Calculate the correlation coefficient for the following datasets.

x	51	55	78	63	61	89	77
y	58	62	57	61	57	82	58

x	y	x^2	y^2	xy
51	58			
55	62			
78	57			
⋮				

$$r = \frac{\frac{\sum xy}{N} - \bar{x}\cdot\bar{y}}{\sqrt{\frac{\sum x^2}{N} - (\bar{x})^2}\sqrt{\frac{\sum y^2}{N} - (\bar{y})^2}} \quad \text{Cov}(x,y)$$

σ_x σ_y

x	y	x^2	y^2	xy
51	58	2601	3364	2958
55	62	3025	3844	3410
78	57	6084	3249	4446
63	61	3969	3721	3843
61	57	3721	3249	3477
89	82	7921	6724	7298
77	58	5929	3364	4466
474	435	33250	27515	29898

$\bar{x} = \frac{474}{7} = 67.71$

$\bar{y} = \frac{435}{7} = 62.14$

$$= \frac{\frac{29898}{7} - (67.71 \times 62.14)}{\sqrt{\frac{33250}{7} - (67.71)^2}\sqrt{\frac{27515}{7} - (62.14)^2}}$$

$$= \frac{4271.14 - 4207.69}{\sqrt{4750 - 4584.64}\sqrt{3930.7 - 3861.32}}$$

$$= \frac{63.45}{12.85 \times 8.32} \quad \text{Cov}, \ \sigma_y$$

σ_x $= \frac{63.45}{106.95} = 0.593$

$r = 0.593$

No perfect direct relationship

Q10: Estimate the value of y when x = 73. Take Value as previous Question.

$y = a + bx$ ← Slope of line

↑ y-intercept

$a = 36.803$

$b = 0.3842$

$a = \bar{y} - b\bar{x}$

$b = \frac{cov(x,y)}{\sigma_x^2}$

$= \frac{63.45}{(12.85)^2} = 0.3842$

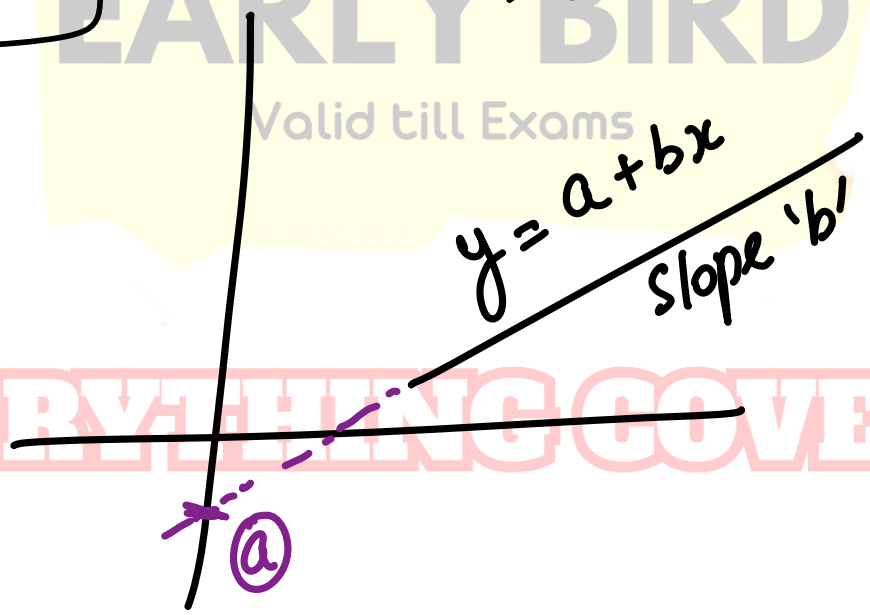
$= 62.14 - 0.3842 \times 67.71$

$= 62.14 - 25.337$

$= 36.803$

$y = 36.803 + 0.3842 \times 73$

$= 64.84$



Q11. Calculate Seasonal Index for years.

Year	Q1	Q2	Q3	Q4	
1998	87	106	86	125	= 404/4 = 101
1999	85	110	83	127	= 405/4 = 101.25
2000	84	105	87	128	= 404/4 = 101
2001	88	104	88	124	= 404/4 = 101

1998 → $\frac{101}{101.0625} \times 100$

= 99.93%

1999 → 100-187.

grand avg = $\frac{101 + 101.25 + 101 + 101}{4}$

= 101.0625

Q12: Manufacturer who produces medicine bottles, find that 0.1% of the bottles are defective the bottles are packed in a box containing 500 bottles A drug manufacturer buys 100 boxes from the producer of bottle using poison distribution find how many boxes will contain no defective? e-0.5 = 0.6065

n

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

$p = 0.1\% = 0.1/100 = 0.001$

$mean = m = np = 500 \times 0.001 = 0.5$

$$= \frac{e^{-0.5} \times 0.5^{0}}{0!} = \frac{0.6065 \cdot 1}{1} = 0.6065$$

mean = variance = λ

skewness = $\beta_1 \rightarrow \frac{1}{\lambda}$

Kurtosis $\rightarrow \beta_2 = 3 + \frac{1}{\lambda}$

The Poisson distribution is a way to model how often an event happens in a fixed interval of time or space, under these simple conditions:

1. **Events occur one at a time** (you can't have two events happening at exactly the same instant).
2. **The average rate is constant** (e.g., you get on average 3 phone calls per hour, every hour).
3. **Events happen independently** (one call doesn't make another call more or less likely).

Q13. Normal population of 1000 employees has mean income Rs. 800 per day and variance 400, Find no. of employees where income between

(i) P (750 < x < 820)

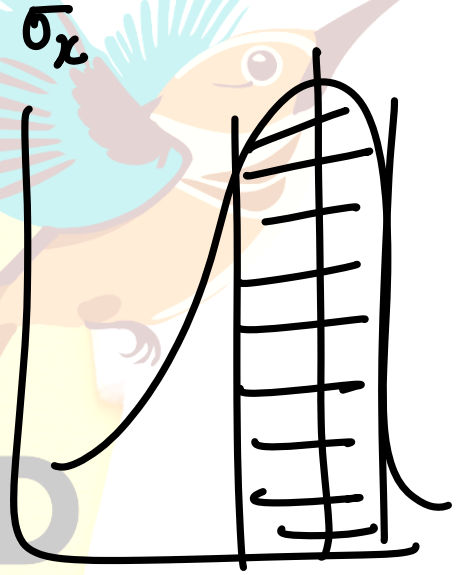
(ii) P (x > 700)

(iii) P (x > 760)

$\mu = 800, \quad \sigma^2 = 400$

$\sigma = 20$

$$Z = \frac{\bar{x} - \mu}{\sigma}$$



$$\frac{750 - 800}{20} < Z < \frac{820 - 800}{20}$$

$$\frac{-50}{20} < Z < \frac{20}{20}$$

$$-2.5 < Z < 1$$

$$= 0.4938 + 0.3413$$

$$= 0.8351$$

$$\times 1000 = 835 \text{ employees}$$

$n = 125$

$\mu = 3250$

$\sigma = 615$

Q14: An undergraduate is interested in purchasing a used TV. She randomly selected 125 advertisements and found that the average price of the TV in this sample was Rs 3250. She knows that the standard deviation of the used TV is Rs 615 in the city

a) Establish an interval for the average price of the TV so that she can be 68.3 percent certain that the population mean lies within this interval

b) Establish an interval for the average price of the TV so that she can be 95.5 percent certain that the population mean lies within this interval

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{615}{\sqrt{125}} = 55$$

$3250 \pm 1\,\sigma_{\bar{x}}$ [68.3%]

3250 ± 55

$3305 - 3195$

$3250 \pm 2\,\sigma_{\bar{x}}$

$3250 \pm 110 \rightarrow 3360 - 3140$ 95.5%.

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999

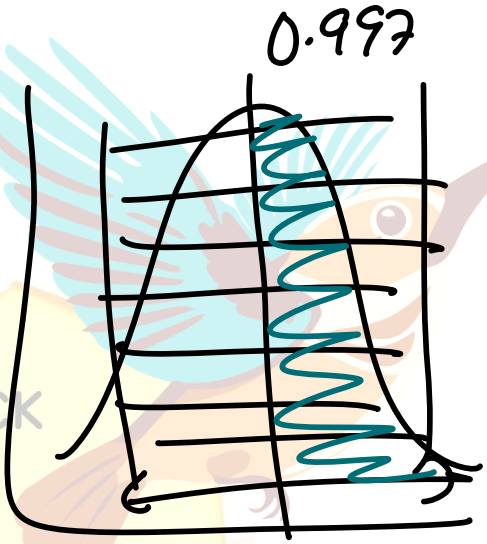
0.4525
0.2967

Q15: For a population with known SD of 1.65, a sample of 32 items resulted in 34.8 as an estimate of the mean.

a) Find the standard error of the mean

b) Compute and interval estimate that should include the population mean 99.7% of the time.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1.65}{\sqrt{32}} = 0.292$$



$$34.8 \pm 2.96 \times 0.292$$

$$34.8 \pm 0.864$$

35.664 − 33.936

99.7%

$Z = 2.96$

0.997/2

0.4988

Q16: A social psychologist surveyed 150 top graduate students and found that 42% of them were unable to add the fractions correctly.

a) Estimate the SE of the population

b) Construct a 99% confidence interval for the true proportion of the graduate who cannot correctly add fractions.

$n = 150$

$p = 0.42$

$q = 1 - 0.42 = 0.58$

$$SE = \sqrt{\frac{pq}{n}} = \sqrt{\frac{0.42 \times 0.58}{150}} = 0.0402$$

I part

$Z \rightarrow 99\% \Rightarrow 0.99/2 = 0.495$

2.58

mean = np

np/n

p

2.58×0.0402

± 0.103

$p \pm 2.58 \times \sigma_x$

0.42 ± 0.103

IInd part

Q17: A company reports the following for the year:

Total revenue (Gross Sales) = ₹1,500,000

Excise duty paid = ₹100,000

Cost of goods sold (COGS) = ₹700,000

Operating expenses = ₹300,000

Non-operating surplus (e.g. rent income) = ₹50,000

Interest expense = ₹20,000

Tax expense = ₹60,000

Compute: Net Sales, Gross Profit, Operating Profit, EBIT, Profit Before Tax, and Profit After Tax.

(I) Net sales
= gross sales − Excise duty
= 1500000 − 100000
= 1400000

(II) gross profit = Net sales − COGS
= 1400000 − 700000
= 700000

III. Operating profit = Gross profit − OE
= 700000 − 300000 = 400000

(IV) EBIT = operating profit + Non operating surplus
= 400000 + 50000 = 450000

(V) PBT = EBIT − I = 450000 − 20000 = 430000

(VI) PAT = PBT − Tax = 430000 − 60000 = 370000

9.30pm

Caiib PDA

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