Enroll. No._____

MARWADI UNIVERSITY

Faculty of Technology

Information and Communication Technology **B.TECH**

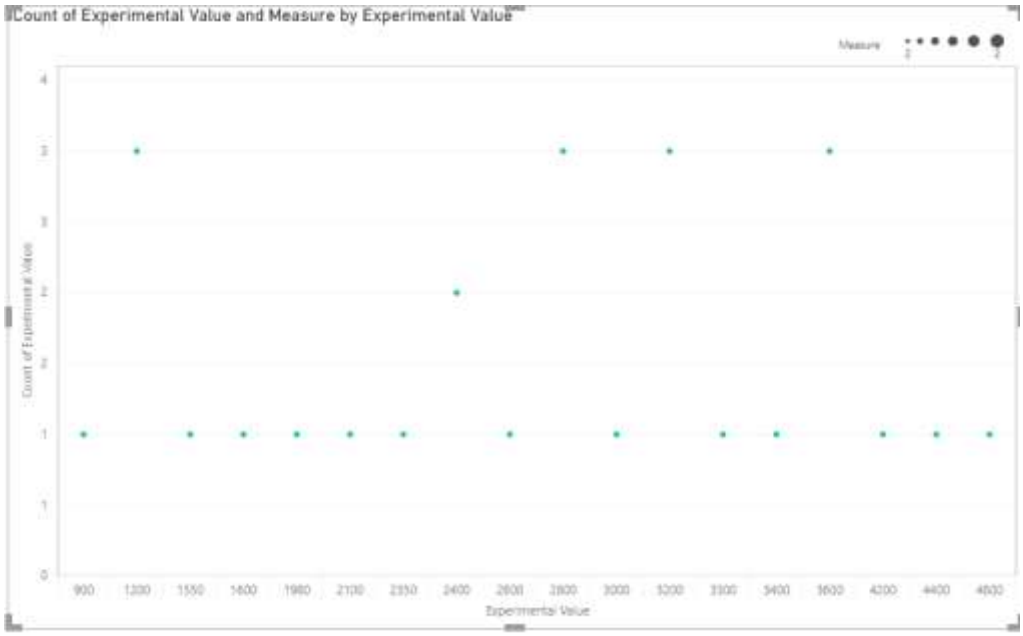
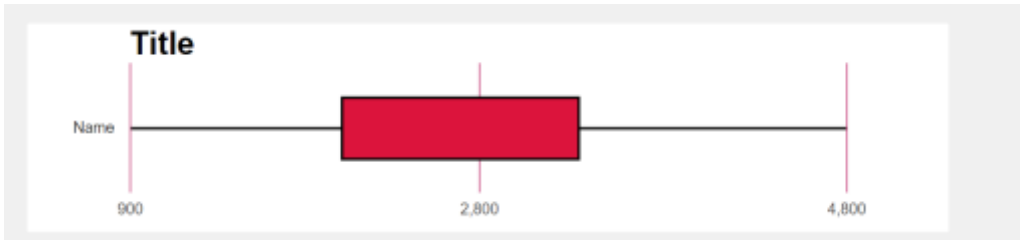
SEM: IV **MU End Sem Practical Test** **April :2024**

Subject: - Probability and Statistics (01CT1401) **Date:-30/04/2024**

Total Marks:-40 **Time: 90 min**

Instructions:

1. **All Questions are Compulsory.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q-1		**Do as directed (CO6)**	**10**
		Use simulator/code to plot dot plot, stem and leaf, box plot, bar chart, and other suitable different types of chart (if any) with the help of coding/scripting/online simulation. Submit the screenshot and inference(comment) of each chart (5 marks)  	

Groups:	Name
Sample size (n):	27
Minimum:	900
Q1:	2040
Median:	2800
Q3:	3350
Maximum:	4800
Mean (x̄):	2717.777778
Skewness:	-0.00989362
Skewness Shape:	Potentially **Symmetrical** (pval=0.982)
Excess kurtosis:	-0.558168
Tails Shape:	Potentially **Mesokurtic**, normal like tails
Outliers:	

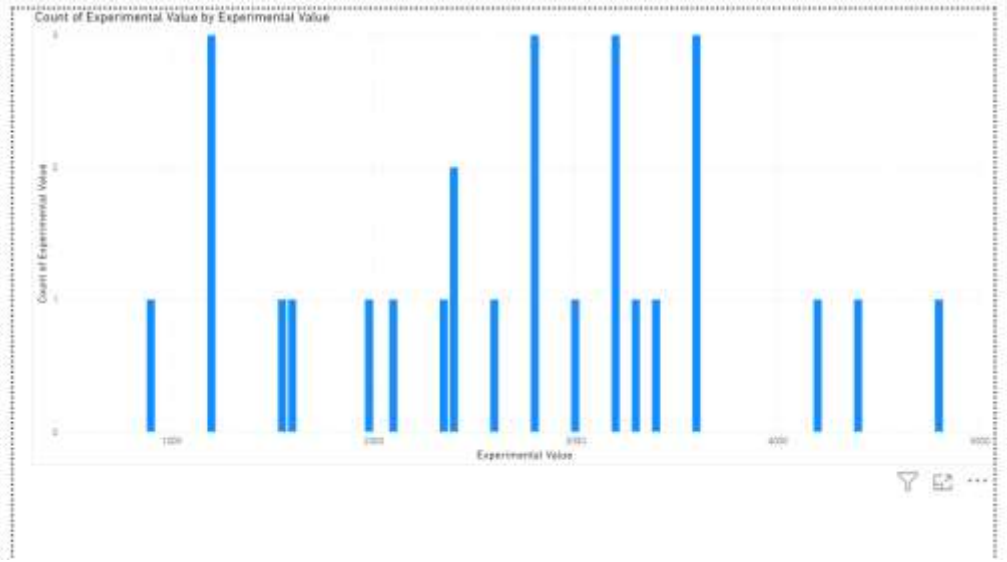
Answer: Print

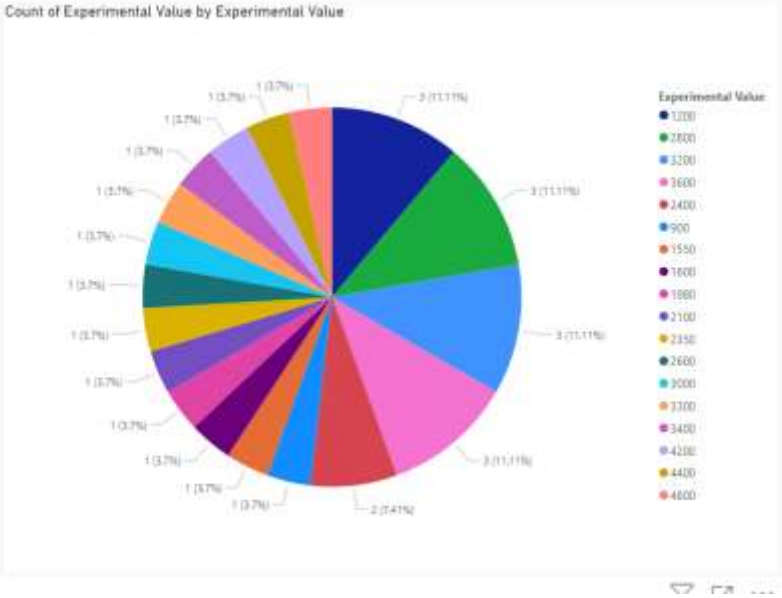
Stem and Leaf Plot

Stem	Leaf
0	900
1	200 200 200 550 600 980
2	100 350 400 400 600 800 800 800
3	000 200 200 200 300 400 600 600 600
4	200 400 800

Calculated Statistics:

Minimum:	900
Maximum:	4800
Range:	3900
Count:	27
Sum:	73380
Mean:	2718
Median:	2800
Mode:	1200, 2800, 3200, 3600
Standard Deviation:	1027
Variance:	1054000





The data set given is for battery specification of various mobiles (fill the blank one with your assumption). The numbers are given with unit mAH

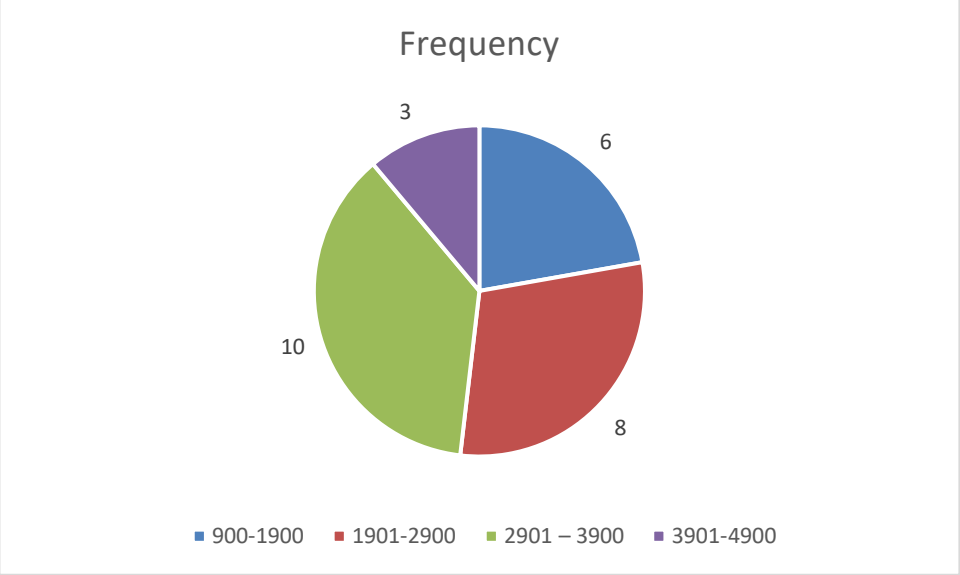
2100, 2800, 3600, 2800, 3300,1200, 1600,1550,3200, 1980, 2350, 3600,3200, 900, 1200, 2400, 3200, 3400,2400, 2600, 2800, 3000,4200, 4400,4800, 3600,1200.

Classify the above batteries in four categories and plot the pie chart. (2marks)
Submit the classification, pie chart screenshot and comment

We can use limit grouping here here we are having smallest observation 900 and highest observation 4800 so we can make class 900-1900 , 1901-2900 , 2901 – 3900 , 3901-4900

Class	Frequency
900-1900	6

1901-2900	8
2901 – 3900	10
3901-4900	3



Use online calculator and find mean, median, mode. (1 mark)

Mean, Median, Mode, Range Calculator

Result

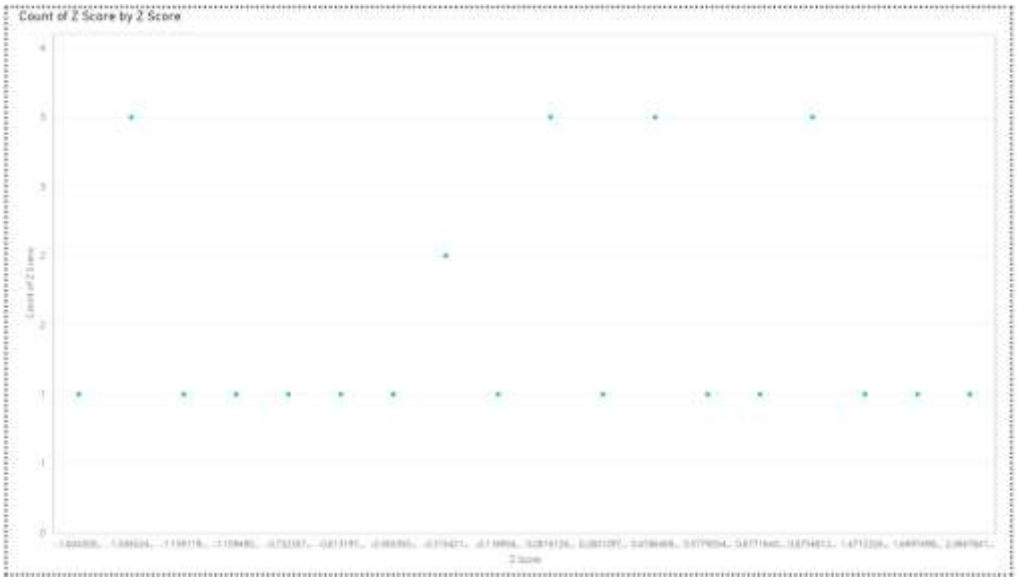
Mean (Average)	2717.7777777778
Median	2800
Range	3900
Mode	3600, 3200, 2800, each appeared 3 times
Geometric Mean	2501.7264089587
Largest	4800
Smallest	900
Sum	73380
Count	27

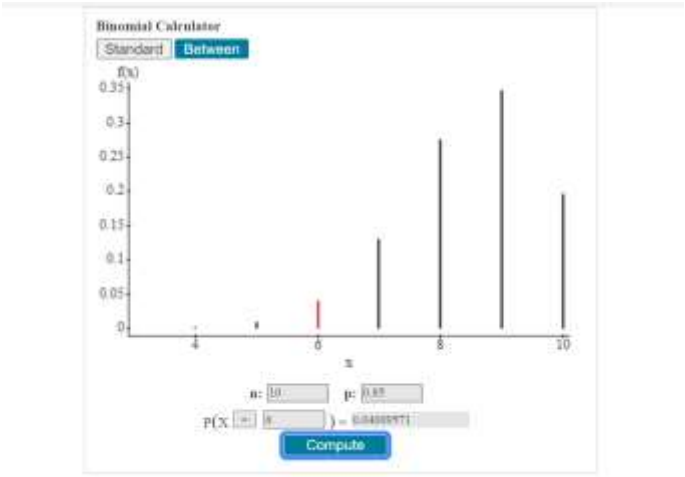
Sorted Data Set: 900, 1200, 1200, 1200., 1550, 1600, 1980, 2100, 2350, 2400, 2400, 2600, 2800, 2800, 2800, 3000, 3200, 3200, 3200, 3300, 3400, 3600, 3600, 3600, 4200, 4400, 4800

Here we found 3 mean means it is multimodal distribution. And mean is less than median so it is left skewed.

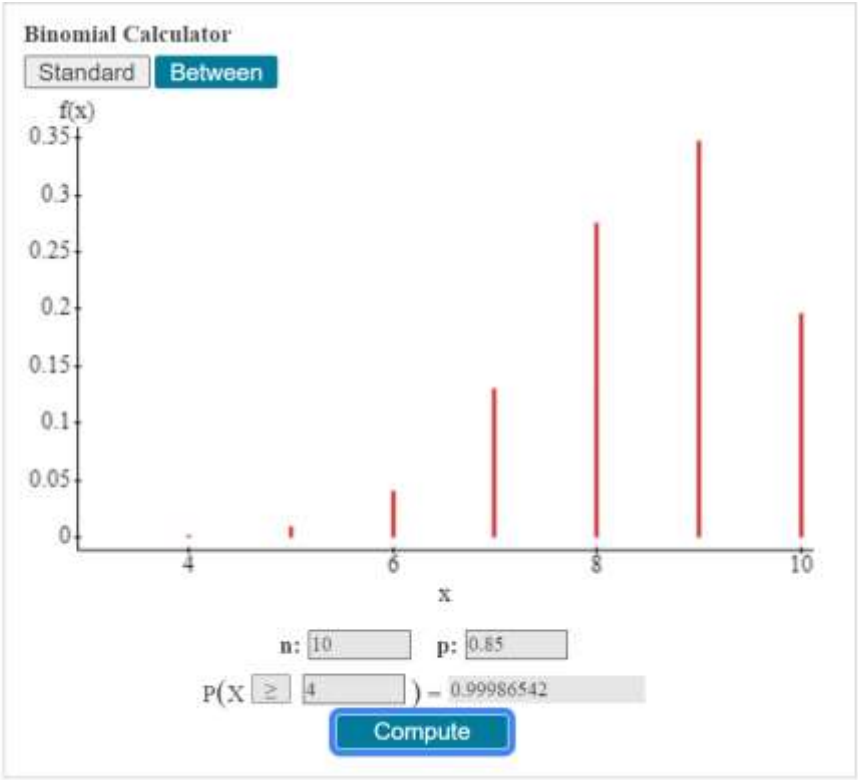
Using online Z score converter/writing code convert the given battery specification in to Z value and plot the new dot plot. (submit screen shot of conversion and dot plot) (1 mark)

Experimental Value	Z Score
2100	-0.6132
2800	0.081613
3600	0.875681
2800	0.081613
3300	0.577905
1200	-1.50652
1600	-1.10949
1550	-1.15912
3200	0.478647
1980	-0.73231
2350	-0.36505
3600	0.875681
3200	0.478647
900	-1.8043
1200	-1.50652
2400	-0.31542
3200	0.478647
3400	0.677164
2400	-0.31542
2600	-0.1169
2800	0.081613
3000	0.28013
4200	1.471233
4400	1.66975
4800	2.066784
3600	0.875681
1200	-1.50652

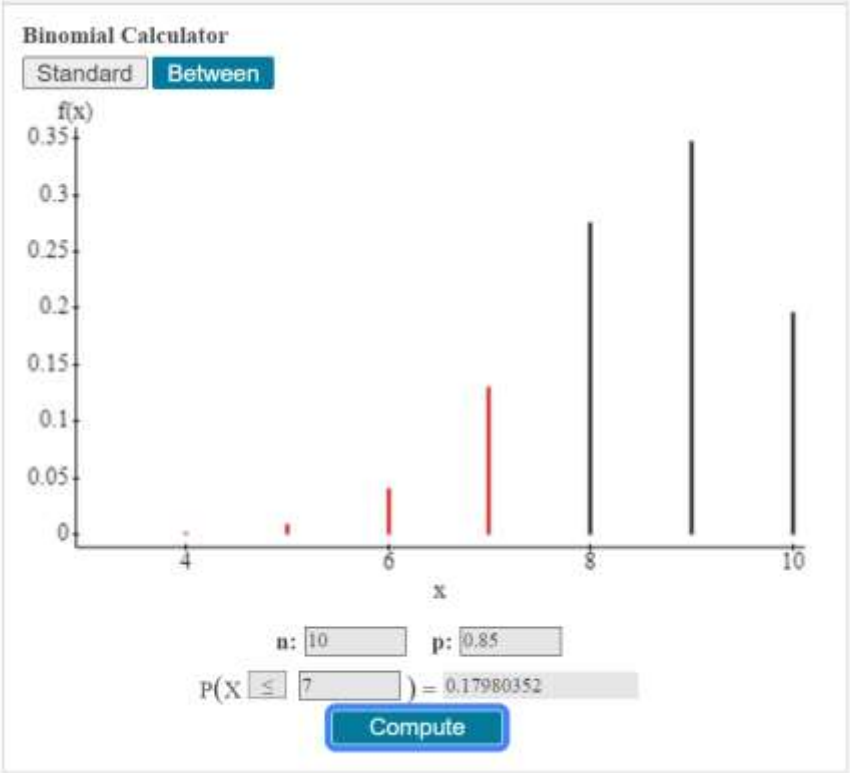


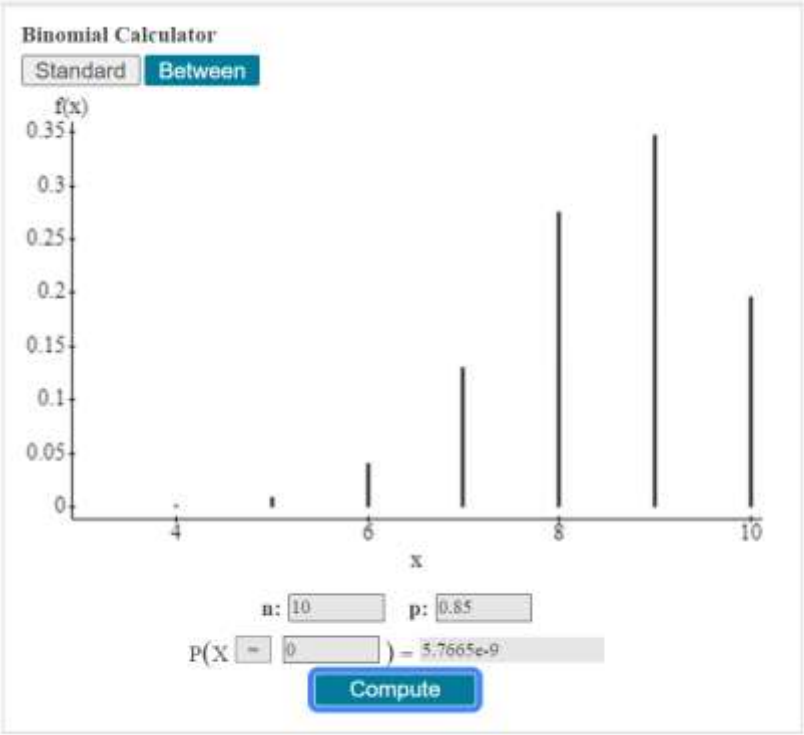
		From the above plots and data metrics comment on the nature of distribution (1 mark) From the above matrices we can conclude that it is a multimodal distribution having 4 modes on 1200 , 2800 , 3200 , 3600	
Q-2		**Do as directed (CO6)**	
	(a)	**Perform online simulator for the answer of the following case study.** **Submit the screenshot and inference(comment)** **(Any two)**	**8**
		(i) If the probability is 0.85 that fully charged digital camera battery will take 150 or more pictures, find the probabilities that among 10 such batteries (a) 6 will take 150 pictures or more; 	

(b) at least 4 will take 150 pictures or more;



(c) at most 7 will take 150 pictures or more



		(d) 0 will take 150 pictures or more 	
		(ii) If 3 of 10 new buildings in a city violate the building code, what is the probability that a building inspector, who randomly selects 4 of the new buildings for inspection, will catch (a) none of the new buildings that violate the building code? (b) 2 of the new buildings that violate the building code? (c) At least 3 of the new buildings that violate the building code? **(d)** All of the new buildings that violate the building code?	
		(iii) (a)Find the area under the standard normal curve that (i) Lies to the left side of 0	

Z-score and Probability Converter

Please provide any one value to convert between z-score and probability. This is the equival referencing a z-table.

Result

Given Z = 0,

P(x<Z) = 0.5

P(x>Z) = 0.5

P(0<x<Z) = 0

P(-Z<x<Z) = 0

P(x<-Z or x>Z) = 1

Z-score, **Z**	0
Probability, **P**(x<Z)	
Probability, **P**(x>Z)	
Probability, **P**(0 to Z or Z to 0)	
Probability, **P**(-Z<x<Z)	
Probability, **P**(x<-Z or x>Z)	

Calculate Clear

(ii) Lies to the left side of -4

Z-score and Probability Converter

Please provide any one value to convert between z-score and probability. This is the equivalent of referencing a z-table.

Result

Given Z = -4,

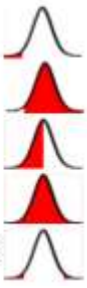
P(x<Z) = 0.00003

P(x>Z) = 0.99997

P(Z<x<0) = 0.49997

P(-Z<x<Z) = 0.99994

P(x<-Z or x>Z) = 0.00006



(iii) Lies to the right side of -1.2

Z-score and Probability Converter

Please provide any one value to convert between z-score and probability. This is the equivalent of referencing a z-table.

Result

Given Z = -1.2,

P(x<Z) = 0.11507

P(x>Z) = 0.88493

P(Z<x<0) = 0.38493

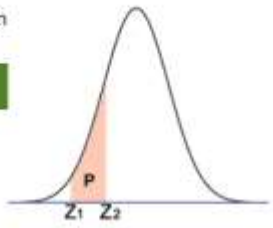
P(-Z<x<Z) = 0.76986

P(x<-Z or x>Z) = 0.23014

(iv) Lies between -1 and 1

Probability between Two Z-scores

Use this calculator to find the probability (area P in the diagram) between two z-scores.



Result

P(-1<x<1) = 0.68269

P(x<-1 or x>1) = 0.31731

P(x<-1) = 0.15866

P(x>1) = 0.15866

Left Bound, Z_1	-1
Right Bound, Z_2	1

Calculate Clear

(b) Determine the values of $Z_{0.90}$ and $Z_{0.06}$

Z-score and Probability Converter

Please provide any one value to convert between z-score and probability. This is the equivalent of referencing a z-table.

Result

Given Z = 0.9,

P(x<Z) = 0.81594

P(x>Z) = 0.18406

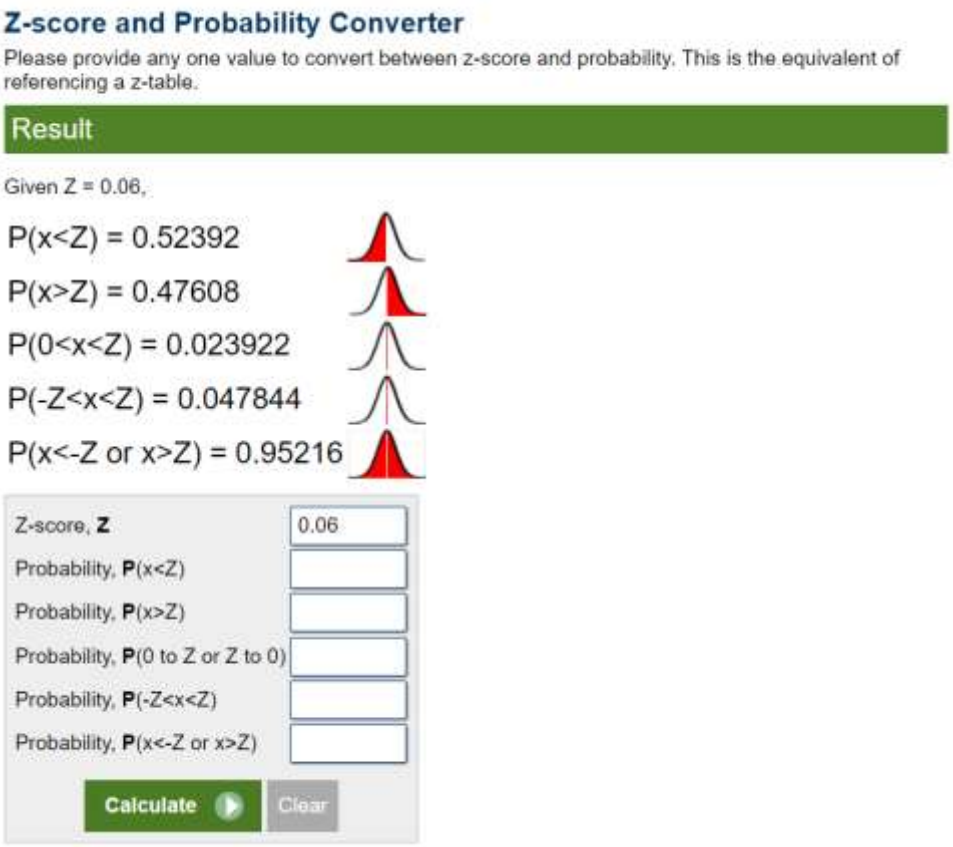
P(0<x<Z) = 0.31594

P(-Z<x<Z) = 0.63188

P(x<-Z or x>Z) = 0.36812

Z-score, **Z**	0.9
Probability, **P**(x<Z)	
Probability, **P**(x>Z)	
Probability, **P**(0 to Z or Z to 0)	
Probability, **P**(-Z<x<Z)	
Probability, **P**(x<-Z or x>Z)	

Calculate Clear

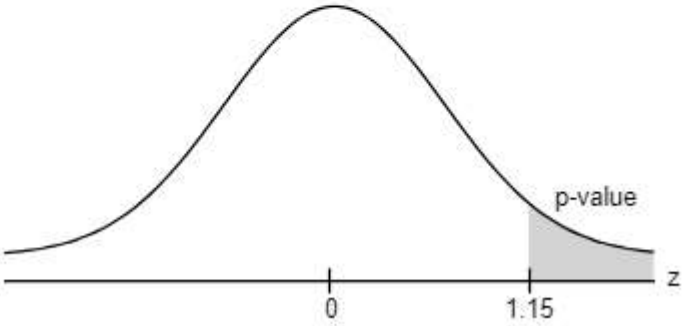


	(b)	**Perform online simulator for the answer of the following case study. Submit the screenshot and inference(comment) (Any two)**	**6**
		(i) In 52 randomly selected hours of production, the mean and the standard deviation of the number of acceptable piece produce by a automatic sampling machine are $\bar{x}$ = 1.022 and s =138. At the 0.05 level of significance does this enable us to reject the null hypothesis $\mu = 1000$ against the alternative hypothesis $\mu > 1000$?	

Test Statistic:

$$z = \frac{\bar{x} - \mu_o}{\sigma/\sqrt{n}} = \frac{1022 - 1000}{138/\sqrt{52}} = 1.15$$

p-Value Approach:



Standard Normal Table

z	.03	.04	.05	.06	.07
1.0	.8485	.8508	.8531	.8554	.8577
1.1	.8708	.8729	.8749	.8770	.8790
1.2	.8907	.8925	.8944	.8962	.8980

p-value $= 1 - .8749 = .1251$

Rejection Rule: Reject H_0 if p-value $\leq .05$

p-value $= .1251 > \alpha = .05$

Conclusion: Do Not Reject H_o

Interpretation: Can't conclude $\mu > 1000$

Critical Value Approach:

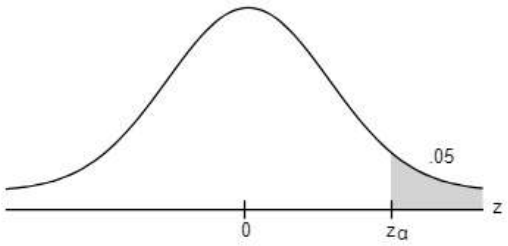
Rejection Rule: Reject H_0 if p-value $\leq .05$

p-value $= .1251 > \alpha = .05$

Conclusion: Do Not Reject H_o

Interpretation: Can't conclude $\mu > 1000$

Critical Value Approach:



Standard Normal Table

z	.02	.03	.04	.05	.06
−1.7	.0427	.0418	.0409	.0401	.0392
−1.6	.0526	.0516	.0505	.0495	.0485
−1.5	.0643	.0630	.0618	.0606	.0594

Critical Value: $z_\alpha = 1.64$

Rejection Rule: Reject H_0 if $z \geq z_\alpha$

$z = 1.15 < z_\alpha = 1.64$

Conclusion: Do Not Reject H_o

Interpretation: Can't conclude $\mu > 1000$

(ii) A random sample of 6 steel beams has a mean compressive strength of 58,392 psi (pounds per square inch) with a standard deviation of 648 psi. Use this information and the level of significance α =0.05 to test whether the true average compressive strength of the steel from which this sample came is 58000 psi. assume normality.

Hypothesis Testing Calculator

H_o: μ = 5800

H_a: μ ≠ 58000

n = 6 $\bar{x}$ = 58392 σ = 648

Level of Significance: α = .05

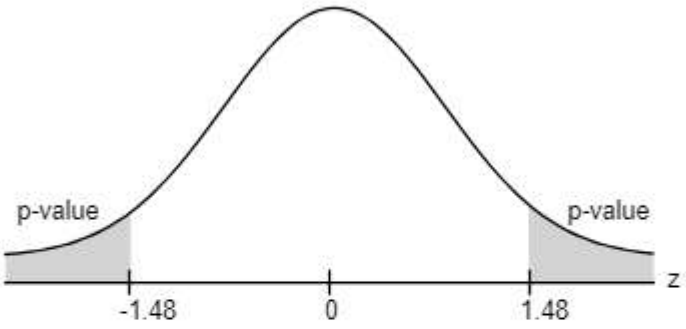
Solve

Example 1 • Example 2

Test Statistic:

$$z = \frac{\bar{x} - \mu_o}{\sigma/\sqrt{n}} = \frac{58392 - 58000}{648/\sqrt{6}} = 1.48$$

p-Value Approach:



Standard Normal Table

z	.05	.06	.07	.08	.09
1.3	.9115	.9131	.9147	.9162	.9177
1.4	.9265	.9279	.9292	.9306	.9319
1.5	.9394	.9406	.9418	.9429	.9441

$$p\text{-value} = 2(1 - .9306) = .1388$$

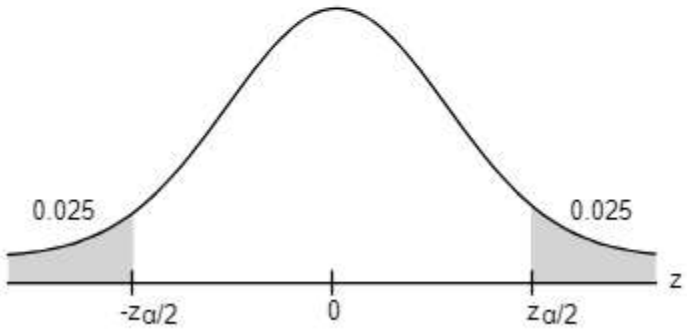
Rejection Rule: Reject H_0 if p-value $\leq .05$

p-value $= 0.1388 > \alpha = .05$

Conclusion: Do Not Reject H_o

Interpretation: Can't conclude $\mu \neq 58000$

Critical Value Approach:



Standard Normal Table

z	.04	.05	.06	.07	.08
−2.0	.0207	.0202	.0197	.0192	.0188
−1.9	.0262	.0256	.0250	.0244	.0239
−1.8	.0329	.0322	.0314	.0307	.0301

Critical Values:

$-z_{\alpha/2} = -1.96$ and $z_{\alpha/2} = 1.96$

Rejection Rule:

Reject H_0 if $z \leq -z_\alpha$ or if $z \geq z_\alpha$

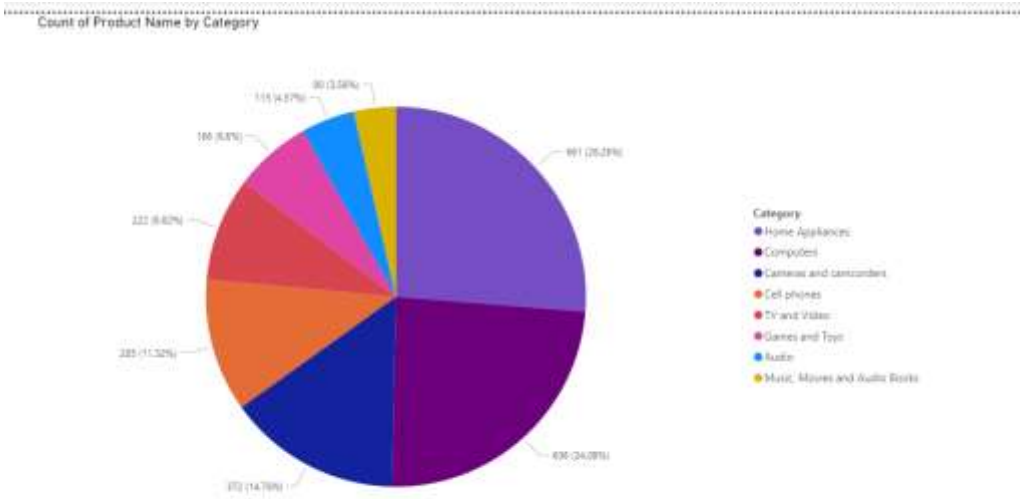
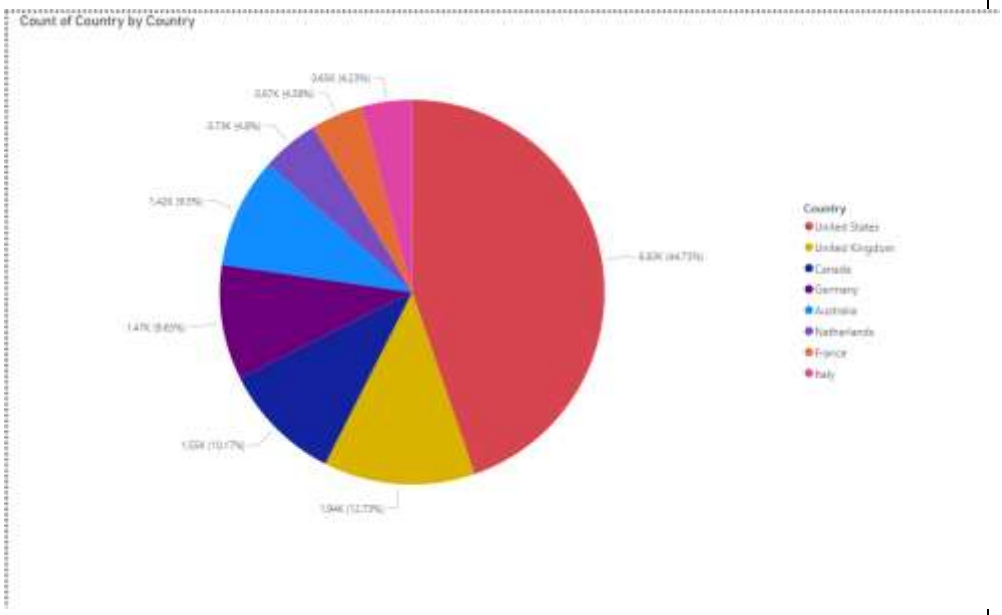
$z = 1.48 > -z_{\alpha/2} = -1.96$

and $z = 1.48 < z_{\alpha/2} = 1.96$

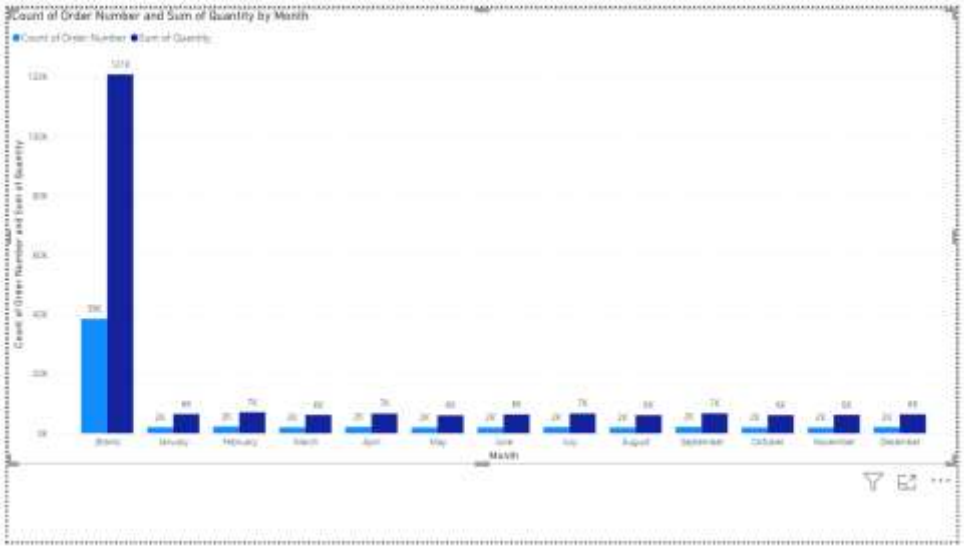
Conclusion: Do Not Reject H_o

Interpretation: Can't conclude $\mu \neq 58000$

(iii) The dynamic modulus of concrete is obtained for two different concrete mixes. For the first mix n1 = 33, $\bar{x}$ = 115.1 and s1 =0.47 psi. For the second mix n2 =31, $\bar{x}$ = 114.6 and s2 =0.38. Test with $\alpha = 0.05$ the null hypothesis of equality of mean dynamic modulus versus the two sided alternative.

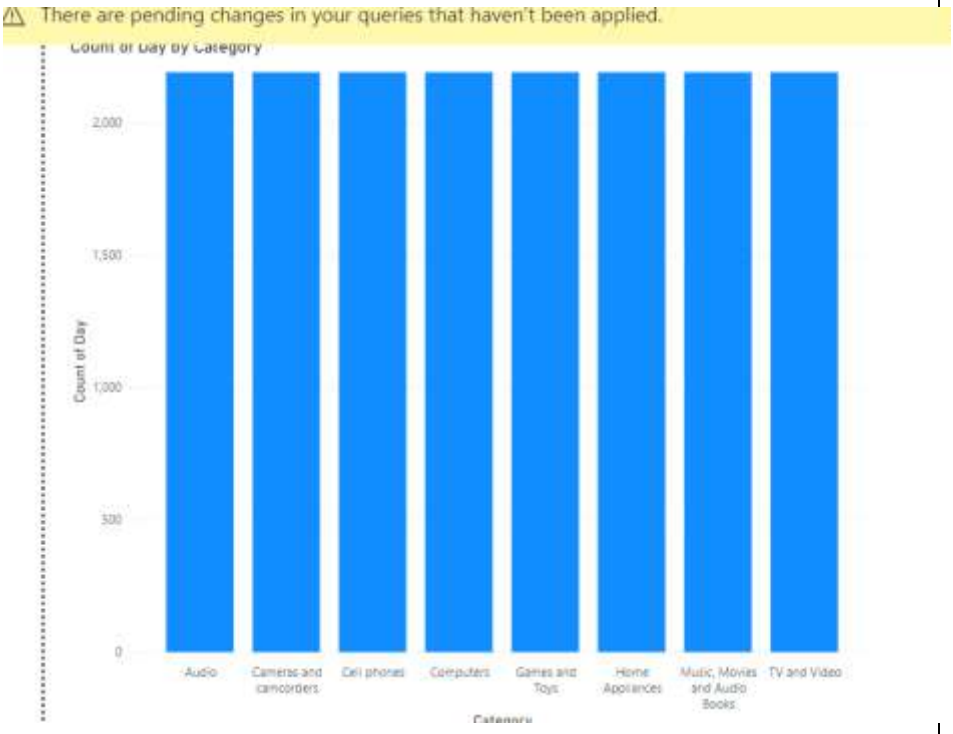
Q-3		During continuous evaluation of Internal assessment, you have been given one assignment of statistical analysis tool exploration. Each of you has selected different tools. Using the same tool and the given data sheet in mail, prepare various statistical graphs, metrics and inference. The data set is given in an attachment. The brief about data is give here. You should use your own understanding for what to analyze (also u can do other then recommended analysis) **Global Electronics Retailer** Sales data for a fictitious global electronics retailer, including tables containing information about transactions, products, customers, stores and currency exchange rates. **Recommended Analysis** 1. What types of products does the company sell, and where are customers located?  	**16**

2. Are there any seasonal patterns or trends for order volume or revenue?



There is almost same order volume and revenue is generated.

3. How long is the average delivery time in days? Has that changed over time?



4. Is there a difference in average order value (AOV) for online vs. in-store sales?