Mathematics for Data Science Practice Problems

1	Find the null space of A=$\begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix}$
2	Find the Eigen value and eigen vector of $\begin{bmatrix} 1 & 7 & 8 \\ 0 & -3 & 9 \\ 0 & 0 & 7 \end{bmatrix}$
3	Find A basis for each of four fundamental subspaces of $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 6 & 4 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$
4	Find singular value decomposition of $A = \begin{bmatrix} 3 & 3 & 2 \\ 2 & 3 & -2 \end{bmatrix}$
5	Find singular value decomposition of $A = \begin{bmatrix} 2 & 3 \\ 1 & 5 \\ 3 & 4 \end{bmatrix}$
6	Differentiate between qualitative and quantitative data
7	Differentiate between nominal and ordinal da
8	Differentiate between continuous and discrete data
9	Find maximum, mean, median, lower quartile, upper quartile and interquartile range. Also construct a box-whisker plot for the following data: 12, 25, 22, 30, 7, 36, 44, 42, 55, 53, 59
10	Construct a pie chart for the following data: 	Website	Time spent(minutes)
Facebook	60
Whatsapp	80
Instagram	30
Twitter	30
Linked	40	
11	Write difference between stratified sampling and cluster sampling
12	Draw a bar graph for the following data: **Table: Favorite Type of Movie** | Comedy	Action	Romance	Drama	SciFi
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4	5	6	1	4	
13	Draw a histogram for the following data

| 36 | 25 | 38 | 46 | 55 | 68 | 72 | 55 | 36 | 38 |
| 67 | 45 | 22 | 48 | 91 | 46 | 52 | 61 | 58 | 55 |

14	Perform chi square test of independence to see if gender is linked to political system

	Republican	Democrat	Independent	Total
Male	100	70	30	200
Female	140	60	20	220
Total	240	130	50	440

(critical value=5.9991 at 5% L.O.S.)

15	A sample of 10 students was chosen from a total of 150 students. Calculate the sample's t-test score if the mean score of the entire class is 78 and the mean score of the sample is 74 with a standard deviation of 3.5. Also, comment on whether the sample statistics are significantly different from the population at a 5% level of significance. (critical value of $t_{(0.025)}=3.61$)
16	The probability density function of random variable X is

X	0	1	2	3	4	5	6
P(X=x)	2K	5k	7k	9k	11k	13k	17k

Find (a) k (b)Mean (c) Variance

17	State and Explain Central limit theorem
18	Let X be a continuous random variable with probability density function $f(x)=kx(1-x)$, $0 \le x \le 1$, then find k, mean and variance.
19	The weight of a certain population of young adult females are approximately normally distributed with mean of 132 and standard deviation 15. Find the probability that a subject selected at random from this population will weight: i)More than 155 pounds, ii) 100 pounds or less
20	The following are the systolic blood pressure of 10 patients undergoing during therapy for hypertension 183, 152, 178, 194, 163, 144, 114, 178, 118, 158, Can we conclude on the basis of these data that the population mean is less than 165?
21	In a zoological park there are 1000 creatures as per the following table given below:

Beast Animals	Other than land animals	Birds	Water	Reptiles
150	400	225	175	50

| 22 | Mr. Bond's monthly income is $ 2400 and his monthly expenditure on rent is $ 250. Find the central angle of the sector representing rent expenses in the pie chart . |