International Journal of Computer Sciences and Engineering
Vol.**12**, Issue.**6**, pp.**44-49**, June **2024**
ISSN: 2347-2693 (Online)
Available online at: www.ijcseonline.org

Research Article

A Statistical Study of Verifiable Ideal Standard Based on the Expected Number of Exceedances in Dehradun

Praveen Kumar Bhatt[1], Sudesh Kumar[2], Ankur Nehra[3*]

[1,2]Dept. of Statistics, Sunrise University, Alwar, Rajasthan, 301026, India
[3]Dept. of Mathematics, Dhanauri P.G. College, Dhanauri, Haridwar, Uttarakhand, 247667, India

**Corresponding Author: nehradpgc123@gmail.com*

Received: 16/Apr/2024; **Accepted**: 18/May/2024; **Published**: 30/Jun/2024. **DOI**: https://doi.org/10.26438/ijcse/v12i6.4449

***Abstract*:** The development of a Statistically Verifiable Ideal Standard (SVIS) is achieved with the assistance of the Neyman Pearson speculation testing outline function, where we have built SVIS for different toxins given P(X) (or quantile of request φ_{1-t}) where X is the convergence of specific contamination. By an exceedance, we imply that the level of a toxin is more prominent than a given edge esteem put somewhere near the controller. As such, if irregular variable T is the contamination level and U is the given edge esteem then the occasion (T > U) is called an exceedance. With the assistance of this SVIS rule, we will check the consistency status of different observing locales in Dehradun city for which information is gathered by the Uttarakhand Pollution Control Board (UPCB). Locales are Ghanta Ghar, Ballupur Flyover, Prem Nagar Chowk, Raipur Road, Mussoorie Road, Dharampur Haridwar Road

Keywords: Development of SVIS, Construct SVIS, Construct Power Function, Confidence Interval

1. Introduction

In this part, we will examine the development of a Statistically Verifiable Ideal Standard (SVIS) for air poisons in light of the anticipated number of exceedances. The development of SVIS is achieved with the assistance of Neyman Pearson speculation testing outline function as in section 2, where we have built SVIS for different toxins given P(X) (or quantile of request φ_{1-t}) where X is convergence of a specific contamination. By an exceedance, we imply that the level of a toxin is more prominent than a given edge esteem put somewhere near the controller. As such, if irregular variable T is the contamination level and U is the given edge esteem then the occasion (T > U) is called an exceedance. To control contamination, climate standard is created. In India, the air contamination standard declared by NAAQS is a feasible guideline as it determines that the furthest constraint of surrounding poison fixation is "not to be surpassed over 2% per time" at a given observing area. So as opposed to this standard we utilize the idea of a Genuinely Unquestionable Ideal Norm (SVIS) presented by Barnett and O'Hogan (1997) and build the SVIS given the anticipated number of exceedances. In section 2, we talk about the development of SVIS in light of the expected number of exceedances for one year through the Neyman Pearson speculation testing structure. In section 3, we build SVIS in light of the normal number of exceedances for a long time. In section 4, we acquire power capability for the test and draw its power bend. In section 5, we process the number of exceedances for different poisons at various observing destinations for the information of years 2022, 2023, and 2024 gathered by Uttarakhand Pollution Control Board (UPCB). and look at the consistency status of different monitoring sites through SVIS given the anticipated number of exceedances. In section 6, we examine the development of SVIS given the expected number of exceedances through certainty stretch methodology. In section 7, we process certainty stretch and with the assistance of certainty span, we acquired the SVIS model. With the assistance of this SVIS rule, we will check the consistency status of different observing locales in Dehradun city for which information is gathered by the Uttarakhand Pollution Control Board (UPCB). Locales are Clock Tower chowk / Ghanta Ghar, Ballupur Fly over, Prem Nagar Chock, Raipur Road, Mussoorie Road, Dharampur Chock Haridwar Road

2. Development of SVIS

In this part, we develop the SVIS given the anticipated number of exceedances. We continue as beneath:
Allow T to signify 24 hourly fixation levels of a specific contamination saw on a specific day. Allow U to signify the edge esteem set by the routineness body for specific contamination. On the off chance that T > U on a specific day, we say that it is one exceedance of the norm for a specific poison. If n is the quantity of perception for the level of a specific toxin at any checking site in a specific year and on

© 2024, IJCSE All Rights Reserved

the off chance that X is the number of exceedances in that year, X has binomial conveyance with boundary n =96 (number perception in a year) and

t = D [T > U],

i.e., X ~ B (n, t)

So, for the construction of SVIS, we test the hypothesis

I_0: P(X) ≤ 2

against

I_1: P(X) > 2

Note that

$$P\left(X\right)=\varphi=nt \qquad \dots (1)$$

where

θ is the expected number of exceedances

Now the hypothesis become

I_0: t ≤ 2/96

against

I_1: t > 2/96 … (2)

We define random variable T_i, i = 1, 2, …, n as below:

$$T_i=\begin{cases}1 & if\ T_i>U\\ 0 & otherwise\end{cases} \qquad (3)$$

Since n is large, $X=\sum_{i=1}^{n}T_i$ follows the normal distribution with mean np and variance npq.

Now to test the above hypothesis, we use UMP size α test Φ(X) (say) to test H_0 versus H_1, which has the following form:

$$\phi(x)=\begin{cases}1 & if\ \sum_{i=1}^{n}T_i\ge C\\ 0 & if\ \sum_{i=1}^{n}T_i<C\end{cases} \qquad \dots (4)$$

where c is some constant which is so obtained such that the size of the test is obtained

i.e., $D\left[Reject\ \mathrm{I}_0 \mid \mathrm{I}_0\right]=\alpha$ (5)

Now consider $D\left[Reject\ \mathrm{I}_0 \mid \mathrm{I}_0\right]=\alpha$

$$D\left[\frac{\Sigma T_i-nt}{\sqrt{ntq}}\ge C \mid t=2/96\right]=0.05$$

$$D\left[V\ge\frac{c-nt}{\sqrt{ntq}} \mid t=2/96\right]=0.05 \qquad \dots (6)$$

putting n=96 and p=2/96 we get (as there are 96 observations on a pollutant in a particular year), we have

$$D\left[V\ge\frac{96C-192}{134.34}\right]=0.05 \qquad \dots (7)$$

Now to obtain C, we compare (7) with the following equation:

$$D[V\le v_a]=0.95$$

Since $V\sim N(0,1)$ so

$V_\tau=1.64$ ... (8

and $\frac{96C-192}{134.34}=1.64$,

$$C=4.29\approx 4 \qquad \dots (9)$$

3. Construction of SVIS Based on Three Years Exceedances

Here, we construct SVIS based on exceedances for three years together. In some countries, the standard is based on the exceedances for three years. As in the USA, the ozone standard is based on the expected number of exceedances in three years. Let Y represent the total number of exceedances in three years then Y will follow a binomial distribution with parameters n_1 and p_1 (say). So, for constructing SVIS based on expected exceedances of three years, we will test the hypothesis:

I_0: P(Y) ≤ 6

Against I_1: P(Y) > 6

Note that P(Y) = 6 = n_1 t_1 … (10)

t_1 = 2/96 = t … (11)

Since n_1 = 3n =288 n = 96 is the total number of observations in a particular year. Thus, p is the same for both cases but the numbers of trials n_1 are different as n_1 = 3n so our hypothesis will become:

$$I_0:t\le 2/96$$

Against $I_1:t>2/96$ ... (12)

We define random variables $T_i,\ i=1,2,...,n_1$ as below:

$$T_i=\begin{cases}1 & if\ T_i>U\\ 0 & otherwise\end{cases} \qquad \dots (13)$$

Then, $Y=\sum_{i=1}^{n}T_i=$ the total number of exceedances in three years out of n, observation

Since n_1 is large, $Y=\sum_{i=1}^{n}T_i$ follows normal distribution with mean n_1p_1 and variance $n_1p_1q_1$ (p_1 = p)

Now to test the above hypothesis, we use the UMP size a test $\Phi(Y)$ (say) to test $H_0\ vs\ H_1$, which has the following form:

$$\Phi(Y)=\begin{cases}1 & if\ Y\ge C\\ 0 & if\ Y<C\end{cases} \qquad \dots (14)$$

where c is some constant which is so obtained that the size of the test is obtained

i.e., $D\left[Reject\ \mathrm{I}_o \mid I_o\right]=\tau$ … (15)

Now consider,

$$D\left[\frac{Y-t_1t}{\sqrt{n_1tq}}\ge C \mid t=2/96\right]=0.05$$

© 2024, IJCSE All Rights Reserved

$$D\left[V \geq \frac{c-n_1 t}{\sqrt{n_2 tq}} \mid t = 2/96\right] = 0.05 \qquad \text{... (16)}$$

Putting n_1 = 288 and p = 2/96 we get (as there are 288 observations on a pollutant in 3 years)

$$D\left[V \geq \frac{96C-576}{232.69}\right] = 0.05 \qquad \text{... (17)}$$

Now to obtain C. we compare (17) with the following equation:

$$D\left[V \leq v_a\right] = 0.95$$

Since $V \sim N(0,1)$

So, $v_a = 1.64$

$$\frac{96C-576}{232.69} = 1.64 \qquad \text{... (18)}$$

We get $C = 9.97 \approx 10$ ... (19)

4. Construction of Power Curve

To construct the power function, we will proceed as below:

Note that, the power function $\pi(\varphi)$ is the probability of rejecting the null hypothesis when φ is the true value of the parameter. Mathematically, the power function is given by:

$$\pi(\varphi) = Power\ function = D\left[Reject\ \mathrm{I}_o \mid \varphi = t\right]$$ (for various values of p)

$$= D\left[\frac{\sum X_i - nt}{\sqrt{ntq}} \geq C \mid t\right]$$

$$= D\left[V \geq \frac{C-nt}{\sqrt{ntq}} t\right]$$

$$Power\ function = D\left[V \geq V_a \mid t\right] \qquad \text{... (20)}$$

Where $V_n = \dfrac{C-nt}{\sqrt{ntq}}$ ... (21)

Now using equation (20), we calculate the values (power) of the power function for various values of parameter t. The Table below gives the power for different values of parameter p.

Table 1: π(t) for various t

Parameter Value "t"	Power Function i.e., π(t)
1/96	0.00128
2/96	0.07623
3/96	0.27801
4/96	0.49902
5/96	0.67605
6/96	0.79966
7/96	0.87993
8/96	0.92975
9/96	0.95971
10/96	0.97731
11/96	0.98743
12/96	0.99315
13/96	0.99632
14/96	0.99806
15/96	0.99899
16/96	0.99948
17/96	0.99974
18/96	0.99987
19/96	0.99994
20/96	0.99997
21/96	0.99999
22/96	0.99999
23/96	1.00000
24/96	1.00000
25/96	1.00000

Now a graph between the different values of "p" and π(p), gives the power curve which is given in the figure below:

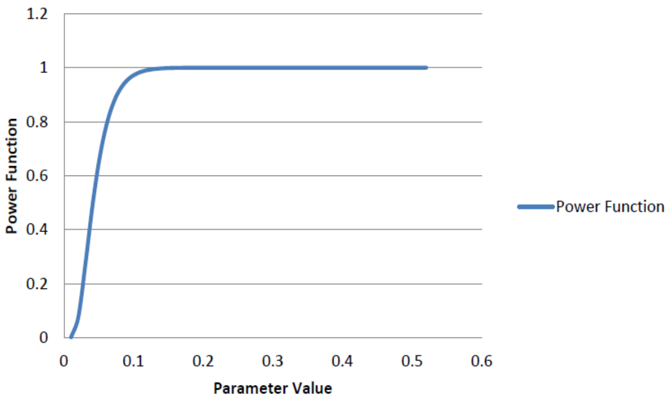

Figure 1: Power Curve

From the above graph, we can see that the power curve is leading to zero for t < 2/96 and leading to 1 for t > 2/96. So, we see the probability of rejecting I_0 when I_1 is true tending to 1 so our test is consistent which a desirable property of the test is.

5. Calculation of the Number of Exceedances

From the data collected by the Uttarakhand Pollution Control Board (UPCB). for the years 2022, 2023, and 2024 compute the number of exceedances for all three years for each monitoring site separately and collectively. The results are given below in the table:

Table 2: Case Study of Number of Exceedances in Dehradun City

Area Names	POLLUTANTS	NUMBER OF EXCEEDANCES			
		2022	2023	2024	Average
Ghanta Ghar	NO_2	0	0	0	0
	RSPM	73	73	83	229
	SO_2	0	0	0	0
Ballupur Fly over	NO_2	0	0	0	0
	RSPM	43	55	70	168
	SO_2	0	0	0	0
Prem Nagar Chowk	NO_2	0	0	0	0
	RSPM	75	80	85	240
	SO_2	0	0	0	0
Raipur Road	NO_2	0	0	0	0
	RSPM	46	54	69	169
	SO_2	0	0	0	0
Mussoorie	NO_2	0	0	0	0

Road	RSPM	90	87	84	261
	SO_2	0	0	0	0
Dharampur Chock Haridwar Road	NO_2	0	0	0	0
	RSPM	95	90	87	272
	SO_2	0	0	0	0

From the above table, we observe that at all monitoring sites number of exceedances for pollutants NO_2 and SO_2 is zero for all three years while for RSPM (Respirable Suspended Particulate Matter) number of exceedances is high in number for all 3 years. We can say that all 6 sites are under compliance for NO_2 and SO_2 for all three years. While for RSPM, we can say that all 6 sites are out of compliance for all 3 years.

6. Construction of SVIS through Confidence Interval Approach

Here we shall construct SVIS using the confidence interval approach. According to Zar (1999), a $100\left(1-\varphi\right)\%$ confidence interval for t = D [T > U] is given as below:

$$\mathrm{D}\left[LCL_{\varphi}/2 \le \mathrm{t} \le UCL_{\varphi}/2\right] = \left(1-\varphi\right) \quad \dots (22)$$

where

$LCL_{\varphi/2}$ and $UCL_{\varphi/2}$ are given by:

$$D\left(X \ge x \,|\, t = LCL_{\varphi/2}\right) = \varphi/2 \quad \dots (23)$$

$$D\left(X \le x \,|\, t = UCL_{\varphi/2}\right) = \varphi/2 \quad \dots (24)$$

Thus $LCL_{\alpha/2}$ is the lower confidence limit which is the minimum value of p such that the probability of observing at least as many exceedances as we observed is equal to $\varphi/2$. Similarly, $UCL_{\varphi/2}$ which is the upper confidence limit of the confidence interval for t in (22) is the maximum value of t such that the chance of observing no more than the number of exceedances (success) observed is equal to $\varphi/2$. Zar (1999) has shown that

$$LCL_{\varphi/2} = \frac{x}{x+(n-x+1)F_{v_1,v_2,1-\varphi/2}} \quad \dots (25)$$

$$LCL_{\varphi/2} = \frac{(x+1)F_{v_2+2,v_1-2,1-\varphi/2}}{n-x+(x+1)F_{v_2+2,v_1-2,1-\varphi/2}} \quad \dots (26)$$

$v_1 = 2(n-x+1)$ … (27)

$v_2 = 2x$ … (28)

Where, x denotes the number of exceedances and $F_{v_1,\ v_2,\ r}$ denotes the r^{th} quantile of the F- distribution with v_1 and v_2 degree of freedom.

If the numbers of exceedances are zero then we can compute the upper confidence bound.

The upper 100(1-α) % confidence limit is given by:

$$UCL_{\varphi} = 1-\varphi^{1/n} \quad (29)$$

Further, if the number of exceedances is n (total number of observations), then we can compute a lower confidence bound.

The lower $\left(1-\varphi\right)100\%$ confidence limit is given by:

$$LCL_{\varphi} = \varphi^{1/n} \quad \dots (30)$$

Using above defined confidence interval, we will test the hypothesis

I_0: t ≤ 2/96,

Against I_1: t > 2/96.

Thus, corresponding to the size α test for testing

I_0: t ≤ 2/96 against I_1: t > 2/96,

$\left(1-\varphi\right)100\%$

the confidence interval will be $\left[LCL,\ \infty\right]$

And we will reject

I_0 if LCL > 2/96.

7. Calculation of Confidence Interval

Now, from the data collected by the Uttarakhand Pollution Control Board (UPCB) for the years 2022, 2023, and 2024, we compute confidence intervals based on the expected number of exceedances for all 3 years for each monitoring site. The results are given below in Tables 3 to 5:

Table 3: Confidence Interval for Year 2012-22

Area Name	POLLUTANT	N	X	LCL	UCL
Ghanta Ghar	NO_2	104	0	0	0.028394
	RSPM	104	73	0.604319	0.78767
	SO_2	104	0	0	0.028394
Ballupur Fly over	NO_2	98	0	0	0.030106
	RSPM	98	43	0.338668	0.542683
	SO_2	98	0	0	0.030106
Prem Nagar Chowk	NO_2	104	0	0	0.028394
	RSPM	104	75	0.62466	0.804645
	SO_2	104	0	0	0.028394
Raipur Road	NO_2	102	0	0	0.028943
	RSPM	102	46	0.352242	0.55264
	SO_2	102	0	0	0.028943
Mussoorie Road	NO_2	102	0	0	0.028943
	RSPM	102	90	0.80351	0.937709
	SO_2	102	0	0	0.028943
Dharampur Haridwar Road	NO_2	104	0	0	0.028394
	RSPM	104	95	0.842072	0.959663
	SO_2	104	0	0	0.028394

Table 4: Confidence Interval for Year 2022-33

SITE NAME	POLLUTANT	N	X	LCL	UCL
Ghanta Ghar	NO_2	103	0	0	0.028666
	RSPM	103	73	0.610992	0.7941
	SO_2	103	0	0	0.028666
Ballupur Fly over	NO_2	92	0	0	0.032038
	RSPM	92	55	0.490404	0.698769
	SO_2	92	0	0	0.032038
Prem Nagar Chowk	NO_2	103	0	0	0.028666
	RSPM	103	80	0.684017	0.852872
	SO_2	103	0	0	0.028666
Raipur Road	NO_2	96	0	0	0.030724
	RSPM	96	54	0.457461	0.663577

© 2024, IJCSE All Rights Reserved

	SO_2	96	0	0	0.030724
Mussoorie Road	NO_2	97	0	0	0.030412
	RSPM	97	87	0.818571	0.949445
	SO_2	97	0	0	0.030412
Dharampur Haridwar Road	NO_2	98	0	0	0.030106
	RSPM	98	90	0.845475	0.964097
	SO_2	98	0	0	0.030106

Table 5: Confidence Interval for Year 2023-24

SITE NAME	POLLUTANT	N	X	LCL	UCL
Ghanta Ghar	NO_2	96	0	0	0.030724
	RSPM	96	83	0.77957	0.92588
	SO_2	96	0	0	0.030724
Ballupur Fly over	NO_2	95	0	0	0.031042
	RSPM	95	70	0.636493	0.821904
	SO_2	95	0	0	0.031042
Prem Nagar Chowk	NO_2	96	0	0	0.030724
	RSPM	96	85	0.804222	0.941392
	SO_2	96	0	0	0.030724
Raipur Road	NO_2	94	0	0	0.031367
	RSPM	94	69	0.632903	0.819916
	SO_2	94	0	0	0.031367
Mussoorie Road	NO_2	95	0	0	0.031042
	RSPM	95	84	0.802259	0.940759
	SO_2	95	0	0	0.031042
Dharampur Chowk Haridwar Road	NO_2	98	0	0	0.030106
	RSPM	98	87	0.808033	0.942618
	SO_2	98	0	0	0.030106

From the above tables 3, 4, and 5, we note that the LCL of the corresponding 95% confidence interval for NO_2 and SO_2 are less than 2/96 (0.02). So, we conclude that at a 5% level of significance, we accept I_0. That is, for pollutant NO_2 and SO_2 all the six monitoring sites are under compliance. Further from Tables 3, 4, and 5, we observed that the LCL of the corresponding 95% confidence interval for RSPM is greater than 2/96 (0.02). So, we accept I_0 at a 5% level of significance and conclude that for RSPM all six monitoring sites are out of compliance. So there need to be some steps taken regarding pollution control due to pollutant RSPM as it's out of control.

8. Conclusion

With the aid of the Neyman Pearson speculation testing outline function, we have developed SVIS for various toxins based on D(X) (or the quantile of request φ_{1-p} where X represents the convergence of a particular contamination. By an exceedance, we mean that a toxin's level is more noticeable than a certain edge esteem placed next to the controller. Therefore, the occasion (T > U) is referred to as an exceedance in the case where the irregular variable T is the contamination level and U is the provided edge esteem. We will use this SVIS rule to examine the consistency status of several Dehradun city observation locations for which data is collected by the Uttarakhand Pollution Control Board (UPCB).

Data Availability: Data will be made available by the corresponding author upon prior request

Conflict of Interest: Authors do not have any conflict of interest.

Funding Source:
None

Authors' Contributions

Author-1: Involved in protocol development, data analysis, wrote the first draft of the manuscript

Author-2: Introduction Part

Author-3: Conceived the study involved in protocol development, data analysis, wrote the first draft of the manuscript.
All authors reviewed and edited the manuscript and approved the final version of the manuscript.

References

[1] Angus, J. E., 1994: Bootstrap one-sided confidence intervals for the lognormal mean. The Statistician 43, No.**3**, pp.**395-401, 1994.**
[2] Baker, A. G., 1950: Properties of some tests of sequential analysis. Biometrika, 37, pp.**334-346, 1950.**
[3] Barnett, V. and Bown, M. H., 2002: Best linear unbiased quantile estimators for environmental standards. Environmetrics, Vol.**13**, Issue.**3**, pp.**295-310, 2002.**
[4] Barnett, V. and Bown, M. H., 2002: Setting environmental standards: a statistical approach. Quantitative Methods in Current Environmental Issues. Springer-Verlag, London, pp.**99-109, 2002.**
[5] Beer, T., 2000: Setting air quality standards: a case study of the Australian National Environment Protection Measure for Ambient Air Quality. Environmetrics, 11, pp.**499-510, 2000.**
[6] Chami, P., Antoine, R. and Sahai, A., 2007: On Efficient Confidence Intervals for the log-normal mean. Journal of Applied Sciences 7(13), pp.**1790-1794, 2007.**
[7] Cox, L. H., 2000: Statistical issues in the study of air pollution involving airborne particulate matter. Environmetrics, 11, pp.**611-626, 2000.**
[8] Dupuis, D. J., 1998: Exceedances over high thresholds: a guide to threshold selection. Extremes 1:3; pp.**251-261, 1998.**
[9] Finazzi, F., Scott, E. M. and Fasso, S., 2013: A model-based framework for air quality indices and population risk evaluation, with an application to the analysis of Scottish air quality data. Appl. Statist. 62, Part 2, pp.**287-308, 2013.**
[10] Gilbert, R.O. (1987) Statistical Methods for Environmental Pollution Monitoring. John Wiley and Sons, New York, **1987.**
[11] Gun A.M., Gupta M.K., and Dasgupta B. 2013: Fundamental of Statistics. World Press Private Ltd.
[12] Guttorp, P., 2000: Environmental Statistics. Journal of the American Statistical Association, Vol.**95**, No.**449**, pp.**289-292, 2000.**
[13] Guttorp, P.,2000. Setting environmental standards: a statistician's perspective. National Research Center for Statistics and the Environment, Technical Report, Number 48, **2000.**
[14] Krishnamoorthy, K. and Mathew, T., 2003: Inference on the means of lognormal distributions using generalized p-values and generalized confidence intervals. J. of Statistical Planning and Inference 115, 103, **2003.**
[15] Land, C. E., 1971: Confidence intervals for the linear function of the normal mean and variance. Ann. Math. Statisti. 42, pp.**1187-1205, 1971.**

[16] Land, C. E., 1972: An evaluation of approximate confidence interval estimation methods for lognormal means. Technometrics 14, pp.**145-158, 1972.**

[17] Land, C. E., 1973: Standard confidence limits for linear functions of the normal mean and variance. J. Am. Statist. Assoc. 68, pp.**960-963, 1973.**

[18] Lehmann, E.L., 1986: Testing of Statistical Hypothesis. John Wiley and Sons, **1986.**

[19] Martinez-Florez, G., Bolfarine, H. and Gomez, H. W., 2014: The log power normal distribution with application to air pollution. Environmetrics, 25, pp.**44–56, 2014.**

[20] Mood, A.M., Graybill F.A. and Boes, D.C. 2006, 5th reprint, Tata McGraw- Hill Publishing Company Limited, New Delhi, **2006.**

[21] Niwitpong, S. 2013: Confidence intervals for the mean of lognormal distribution with restricted parameter space. App. Math. Sci., Vol.**7**, No.**4**, pp.**161 – 166, 2013.**

[22] Olsson, U. 2005: Confidence intervals for the mean of a lognormal distribution. J. of Statistics Education, Vol. 13, No. 1.

[23] RaoM.N, and Rao HVN. 1989: Air pollution Tata McGraw Hill Publishing Company Limited. New Delhi, **1989.**

[24] Rohatgi, V. K. and Saleh, A. K. 2008, 2nd Edition: An Introduction to Probability and Statistics. Wiley India Pvt Ltd. **2008.**

[25] Tanushree Shekhawat, Yashbir Singh., Air Quality of Jaipur City Based on Statistical Verifiable Ideal Standard (SVIS), International Journal of Applied Environmental Sciences ISSN 0973-6077 Vol.**13**, No.**2**, pp.**121-133, 2018.**

[26] Taralden, G., 2005: A precise estimator for the log-normal mean. Statistical Methodology 2, pp.**111-120, 2005.**

[27] Thompson, M.L., Cox, L.H., Sampson, P.D., and Caccia, D.C., **2000.**

[28] Varotsos, K. V., Tombrou, M. and Giannakopoulos, C., 2013. Statistical estimations of the number of future ozone exceedances due to climate change in Europe. Journal of geophysical research atmosphere, Vol.**118**, Issue.**12**, pp.**6080-6099, 2013.**

[29] Wald and Wolfowitz, 1948: Optimum character of SPRT, Ann. Math.Stat., 19, pp.**336-339, 1948.**

[30] Wald, A., 1947: Sequential Analysis. Wiley, New York.

[31] Weerahandi, S. 1993: Generalized confidence intervals. J. Am. Statist. Assoc. 88, pp.**899-905, 1993.**

[32] Zhang, B. L., Guan, Y., Leaderer, B. P. and Holford, T. R., 2013: Estimating daily nitrogen dioxide level: exploring traffic effects. The Annals of Applied Statistics, Vol.**7**, No.**3**, pp.**1763-1777, 2013.**

[33] Zhou XH, Gao S. 1997: Confidence intervals for the log-normal mean. Statistics in medicine, Vol.**16**, pp.**783-790, 1997.** John Wiley & Sons Ltd.

[34] Zhou XH, Gao S., and Hui, S. L., 1997: Methods for comparing the means of two independent log-normal samples. Biometrics 53, pp.**1129- 1135, 1997.**

AUTHORS PROFILE

Mr. Pravin Kumar Bhatt is a Research Scholar in the Department of Statistics, at Sunrise University, Alwar, (Rajshthan), INDIA, and he is having 3 years of research experience. Areas of interest are Enviromental Satistics.

Dr. Sudesh Kumar, serves as an Assistant Professor, in the Department of Statistics, at Sunrise University, Alwar, (Rajshthan), INDIA, and he is having five years of research experience. Areas of interest is Satistics.

Dr Ankur Nehra serves as an Assistant Professor, Head of the SC/ST/OBC CELL, and Head of the Counselling & Placement Cell at Dhanauri P.G. College, Dhanauri, Haridwar, Uttarakhand, India 247667. His research focus on Vedic mathematics and its Applications in Cryptography has resulted in an impressive scholarly record. With 30 publications in renowned journals and 5 publications as chapters in edited books, and 5 books published in national and international publication house. He has significantly contributed to the field. His book, "Some Vedic Mathematics Sutras for Elliptic Curve Cryptography" is published in an international publishing house. Currently, Dr. Ankur Nehra is editing a book on "Vedic Mathematics and its Applications for Cryptography". He has also taken the lead in editing another book. He has made contributions to mentoring and academic leadership. He is co-supervising two research scholars and submitted a minor research project to UCOST. Being a Life member of the ISCA chapter Haridwar, He actively engages in scholarly communities. His role as a Reviewer for Mathematical Reviews, a division of the Journal of Extension Education, Coimbatore India, reflects his commitment to mathematical research. Dr. Ankur Nehra’s contributions have been recognized through various awards, including the "Young Scientist Award” (08-09 Nov. 2023). His accolades underscore her dedication to advancing mathematical research and education.His research areas are Cryptography, Fuzzy Theory, Graph Theory, and Ancient Indian Mathematics.

© 2024, IJCSE All Rights Reserved