ISSN - 2279 - 0489 AN INTERNATIONAL MULTIDISCIPLINARY HALF YEARLY RESEARCH JOURNAL

GENIUS

Volume - X

Issue - I

August - January - 2021-22

ENGLISH / MARATHI / HINDI PART - I

Peer Reviewed Refereed and UGC Listed Journal No. 47100



IMPACT FACTOR / INDEXING 2019 - 6.631 www.sjifactor.com

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Ajanta Computer, Near University Gate, Jaisingpura, Aurangabad. (M.S.) Printed by Ajanta Computer, Near University Gate, Jaisingpura, Aurangabad. (M.S.) Cell No.: 9579260877, 9822620877 Ph. No.: (0240) 2400877 E-mail: ajanta5050@gmail.com, www.ajantaprakashan.com	sole responsibility lies entirely with the author(s) and does not reflect the official opinion of the Editorial Board, Advisory Committee and the Editor in Chief of the Journal "GENIUS". Owner, printer & publisher Vinay S. Hatole has printed this journal at Ajanta Computer and
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SOLUTION SOLUTION SOLUTION

S. No.	Title & Author			
1	The Financial Nature of the Automobile Industry: A Study in the			
	Context of Current Indian Perspectives			
	Anil Kumar			
2	A Study to Awakening of Woman over Cyber Crime in India	5-8		
	Arvind Navrang Singh			
	Dr. Anil Kumar			
3	A Critical Study to Patent law and TRIP'S Agreement under Indian Laws	9-13		
	Neetu Sharma			
	Dr. Anil Kumar			
4	Uniform Civil Code: A Socio Legal Study in Reference to	14-17		
	Indian Constitution			
	Dr. Rinky Bharti			
	Dr. Anil Kumar			
5	The End of Innocence and Democracy in William Golding's	18-22		
	Lord of the Flies			
	Mr. Nitin Shankar Gawai			
6	An Analytic Study to Classification in Cyber Crime and Cyber	23-28		
	Terrorism in India			
	Arvind Navrang Singh			
	Dr. Anil Kumar			
7	Water, Sanitation, and Hygiene Service in Vaijapur Tehsil Dist. Aurangabad	29-32		
	Mr. Ban K. S.			
	Dr. Hiwale S. D.			
8	A Critical Study on Indian Legal Regime on Patent System to be	33-38		
	Harmonious with Trips Agreement			
	Neetu Sharma			
	Dr. Anil Kumar			
9	Qualitative Evaluation of Pradhan Mantri Awaas Yojana (PMAY - G): A	39-45		
	Case Study of Buldhana District in Maharashtra			
	Dr. Kailas D. Landge			

SOLUTION SOLUTION SOLUTION

S. No.	Title & Author			
10	Maritime Security Challenges to India			
	Suneet Mitra Pandey			
11	Water - Sustainability Consciousness among Secondary Students in India			
	Kolan Padmaja			
	Prof. C. Madhumathi			
12	Supporting Agricultural Business Play a Important Role in Economic			
	Development in Shevgaon and Pathardi Tehsil			
	Dr. D. G. Mane			
13	Shashi Tharoor's an Era of Darkness: Perspectives on History,	62-65		
	Politics, Economic and Culture			
	Satish Narsing Palve			
14	Gandhi's Concept of Gram Swaraj and it's Relevance in Contemporary Pris	66-71		
	Nikhil Jaindra Borkar			
15	Relationship between Human Behaviour and Teaching - Learning Processes	72-77		
	Dr. Mita Howladar			
16	Total Qality Management - The Art of Managing the Whole to	78-82		
	Achieve Excellence			
	Dr. Rajshree S. Rathod			
17	Demonetization in India: Impact on Banking Sector	83-89		
	Dr. Sudhir Shridhar Linge			
	Dr. Sandeep Pandurang Petkar			
	Dr. Shailendrasingh V. Dikit			
18	Prediction of Total Number of Corona Patients Using Least Square Method	90-92		
	Prof. Sandeep Kajabe			
	Prof. Vijay Shinde			

SP CONTENTS OF MARATHI PART - I <₽

अ.क्र.	लेख आणि लेखकाचे नाव	पृष्ठ क्र.	
१	संत नामदेव यांच्या अभंगातील सामाजिक विचार	१-४	
	डॉ. स्वाती व्यंकटराव पाटील		
२	नव्वदोत्तरी कथात्म साहित्यातील वास्तव	4-8	
	प्रा. डॉ. संतोष चव्हाण		
	शिंदे सुनंदा सुंदराराव		
ą	प्रतीत्य समुत्पाद एक तथागतांचा दुख: मुक्तीचा शोध	१०-१५	
	चंद्रशेखर बलराम दहिवेले		
Y	क्रांतीकारक विचारवंत : संत रोहिदास	१६-१७	
	शांतीलाल सांडू गायकवाड		
ч	काया मातीच्या समग्र सौंदर्यातून प्रखर मानवीमूल्य: विञ्चल वाघांची जनककविता	१८-२१	
	डॉ. विशाखा संजय कांबळे		
Ę	भटक्या-विमुक्तांच्या आत्मकथनातील आर्थिक पार्श्वभूमी		
	डॉ. द्रौपदी पंदिलवाड		
b	संत तुकारामांच्या कार्याच्या फलनिष्पत्तीचा शोध		
	डॉ. हनुमंत मारोतीराव भोपाळे		
۷	छत्रपती शिवाजी राजे यांचे स्त्री विषयक विचार		
	प्रा. डॉ. जी. ए. कऱ्हाळे		

9 CONTENTS OF HINDI PART - I **2 4**

अ.क्र.	लेख और लेखकका नाम			
१	राजस्थान में पर्यटन उद्योग एवं अभिगम्यता			
	डॉ. अनिल कुमार जाटावत			

18. Prediction of Total Number of Corona Patients Using Least Square Method

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Abstract

In this paper, we used mathematical method of a time series analysis that is least square method to check the behavior of Covid-19 pandemic. We used the available data of number of positive Covid-19 patients under the condition that number of corona patients continuously increasing with approximately same speed.

Preliminaries

In the subject of Mathematics and Statistics, time series analysis plays an important role. Mathematically, time series is nothing but the function of one variable, that is time variable. Here time variable is denoted by t and values of a function is denoted by y. Thus, mathematically, is denoted as y = f(t). There are various methods which can be applied to study the time series which leads to analysis of time series. The study of time series helps in formulation of future plans and policies. It also enables us to forecast the future changes. In the similar line we are going to use least square method to predict the Covid-19 behavior using past available data. First we will see least square method of a time series analysis.

Result

Graphical representation of the time series tells us that at which point trend of time series is high or low and hence little bit idea of the time series can be obtained. Let y = a + bx be the equations of the straight line trend. Now taking summation on both side for given n set of values, we get the following equation

$$\sum y = na + b \sum x.$$

Now multiply y = a + bx by x and again taking summation, we get the following equation $\sum xy = a\sum x + b\sum x^2$.

From given values of x, we define new values of x, such that $\sum x = 0$. The constant a and b can be calculated as follows and details are given in the reference.

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$$b = \frac{\sum xy}{\sum x^2}$$
 and $a = \bar{y} = \frac{\sum y}{n}$ and hence the values of $y = a + bx$.

We will use above method to check the behavior of Covid-19 under the condition that the number of corona patients remains increasing with approximately same speed. In our case, instead of years, we use a day for time variable. We have listed here the data of number of corona patients found in Maharashtra during the period March 20 2021 to March 26 2021. Following is the data:

Day (from March 20 2021 to March	Number of Corona patients found in
26 2021)	Maharashtra
20 March	27126
21 March	30000
22 March	26672
23 March	28699
24 March	31855
25 March	35952
26 March	35000

Here value of n is equal to 7. We take 22 as a centered value and hence define x = 22. Therefore x will be -3, -2, -1, 0, 1, 2, 3 under the condition $\sum x = 0$. Now we will prepare the following table:

Day	Corona Patients (y)	x	<i>x</i> ²	xy	Trend Values $(y = a + bx)$
20	27126	-3	9	-81378	26396.0358
21	30000	-2	4	-60000	27849.9286
22	26672	-1	1	-26672	29303.8214
23	28699	0	0	0	30757.7142
24	31855	1	1	31855	32211.607
25	35952	2	4	71904	33665.4998
26	35000	3	9	105000	35119.3926

In above table, we will calculate values of y after finding values of a and b. Here

$$n = 7$$
, $\sum y = 215304$, $\sum x^2 = 28$, $\sum xy = 40709$,

Now a and b are calculated using above formulae, we get

$$a = 30757.7142$$
, $b = 1453.8928$,

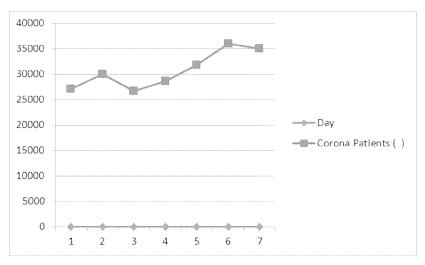
Thus the equation of trend line is

$$y = a + bx = 30757.7142 + 1453.8928x$$
.

Now by putting values of x in above equation, we get all trend values. For example, for x = -3.

$$y = 30757.7142 + 1453.8928 \times (-3) = 26396.0358.$$

It is very easy to calculate all other values of y by putting given values x. Graphical representation of above data is as follows:



Since the values of x are equidistant, values of trend line for future values of x can be calculated. For example on April 6, 2021, the value of x will be 14. Thus value of trend line for x = 14 is

$$y = 30757.7142 + 1453.8928 \times 14 = 51112.2134.$$

Thus, we can make the guess that, on April 6 2021, there will be 51112(approximately) corona patients in Maharashtra. From available data on internet, actual number of corona patients found on April 6 2021 was 55469. Here original value of number of corona patients is not equal to value calculated by the method of least square method, but we will get sufficient information about total number of corona patients in upcoming days.

Conclusion

By using least square method, we can find approximately number of corona patients in upcoming days under some condition. So that we will get enough time to take action against spread of Covid-19 and thus we can make strong medical facility.

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