**Business Statistics**

**April 2023**

**1. Based on the following data develop the forecasting model (adopt Exponential SmoothingTechnique) by considering the following alpha levels. α = 0.2, 0.4, 0.6, 0.8.**

**Write your conclusion after calculations of Errors (MAD and MSE only).**

**Forecast FTAs (foreign tourist arrival) for the year 2018.**

**Data: The following data shows the Foreign Tourist Arrival in the India from 1991 to 2017**

|  |  |
| --- | --- |
| **Year** | **FTAs in India (in Million)** |
| **1991** | **1.68** |
| **2001** | **2.54** |
| **2002** | **2.38** |
| **2003** | **2.73** |
| **2004** | **3.46** |
| **2005** | **3.92** |
| **2006** | **4.45** |
| **2007** | **5.08** |
| **2008** | **5.28** |
| **2009** | **5.17** |
| **2010** | **5.78** |
| **2011** | **6.31** |
| **2012** | **6.58** |
| **2013** | **6.97** |
| **2014** | **7.68** |
| **2015** | **8.03** |
| **2016** | **8.8** |
| **2017** | **10.04** |

**Data Source: Data.gov.in**

**Note: You are advised to calculate manually, do not use any software.**

**Answer: a) α = 0.2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Sales** | **Exponential Smoothing(*α*=0.2)** | **Error** | **|Error|** | **Error2** | **|%Error|** |
| 1991 | 1.68 | 1.68 |  |  |  |  |
| 2001 | 2.54 | 0.2⋅1.68+0.8⋅1.68=1.68 | 2.54-1.68=0.86 | 0.86 | 0.7396 | 33.86% |
| 2002 | 2.38 | 0.2⋅2.54+0.8⋅1.68=1.852 | 2.38-1.852=0.528 | 0.528 | 0.2788 | 22.18% |

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**2. Calculate the Correlations for the following pairs of variables and write your Conclusion.**

* **In Migration of Persons from other states (Census of India) & Total MSMEs**
* **In Migration of Persons from other states (Census of India) & Active Companies**
* **In Migration of Persons from other states (Census of India) & 2017-18 GSDP -CURRENT PRICES (` in Crore)**
* **Total MSMEs & Active Companies**

**Note: Use MS EXCEL, SPSS, SAS etc. for the calculations.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **State** | **Total MSMEs** | **Active**  **Companies** | **In Migration of**  **Persons fromother states(Census of**  **India)** | **2017-18 GSDP**  **– CURRENT**  **PRICES (`in Crore)** |
| **ANDAMAN &**  **NICOBAR ISLANDS** | **6,061** | **319** | **81,267** | **7,871** |
| **ANDHRA PRADESH** | **6,41,929** | **1,16,210** | **15,91,890** | **15,46,313** |
| **ARUNACHAL PRADESH** | **60,932** | **237** | **1,36,010** | **22,432** |
| **ASSAM** | **20,189** | **6,346** | **4,95,699** | **2,88,691** |
| **BIHAR** | **9,02,520** | **20,867** | **11,11,954** | **4,84,740** |
| **CHANDIGARH** | **11,209** | **7,956** | **6,33,966** | **38,760** |
| **CHHATTISGARH** | **69,758** | **7,109** | **12,67,668** | **4,84,740** |
| **DELHI** | **1,63,821** | **2,16,531** | **63,30,065** | **6,86,824** |
| **GOA** | **8,620** | **4,125** | **2,69,689** | **70,494** |
| **GUJARAT** | **8,07,378** | **62,619** | **39,16,075** | **13,28,068** |
| **HARYANA** | **1,85,486** | **30,868** | **36,26,318** | **6,49,592** |
| **HIMACHAL PRADESH** | **14,674** | **3,344** | **3,95,504** | **1,38,351** |
| **JAMMU & KASHMIR** | **9,399** | **2,745** | **1,55,187** | **1,37,427** |
| **JHARKHAND** | **1,57,813** | **9,554** | **21,95,521** | **2,76,243** |
| **KARNATAKA** | **3,32,872** | **68,333** | **32,47,660** | **13,57,579** |
| **KERALA** | **1,25,934** | **31,244** | **6,54,423** | **7,01,577** |
| **MADHYA PRADESH** | **9,34,293** | **22,315** | **27,44,332** | **7,24,729** |
| **MAHARASHTRA** | **16,92,859** | **2,31,912** | **90,87,380** | **24,11,600** |
| **MANIPUR** | **34,423** | **434** | **20,100** | **23,835** |
| **MEGHALAYA** | **2,208** | **560** | **1,07,915** | **30,790** |
| **MIZORAM** | **3,238** | **66** | **41,380** | **18,737** |
| **NAGALAND** | **1,543** | **235** | **1,08,020** | **24,492** |
| **ODISHA** | **1,19,291** | **15,204** | **8,55,096** | **4,34,769** |
| **PUDUCHERRY** | **10,539** | **1,282** | **3,39,967** | **32,962** |
| **PUNJAB** | **2,03,394** | **16,909** | **24,88,299** | **4,78,636** |
| **RAJASTHAN** | **5,72,546** | **37,022** | **26,04,298** | **8,35,170** |
| **SIKKIM** | **875** | **2** | **61,163** | **23,495** |
| **TAMIL NADU** | **10,32,490** | **76,675** | **16,50,771** | **14,61,841** |
| **TRIPURA** | **5,936** | **317** | **87,378** | **44,219** |
| **UTTAR PRADESH** | **8,87,413** | **70,863** | **40,61,933** | **14,60,443** |
| **UTTARAKHAND** | **40,443** | **4,792** | **12,50,575** | **2,22,836** |
| **WEST BENGAL** | **2,31,190** | **1,35,844** | **23,81,045** | **9,99,585** |
| **Data Source** | **https://data.gov.in/** | **https://data.gov.in/** | **https://censusindia.gov.in/** | **https://data.gov.in/** |

**Answer: a)Correlations between Migration of Persons from other states (Census of India) & Total MSMEs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Total**  **MSMEs (X)** | **In Migration of Persons from other states (Census of India) (Y)** | **X-**  **Mean of X** | **Y –**  **Mean of y** | **(X-**  **Mean of X)**  **^2** | **(Y –**  **Mean of y)**  **^2** | **(X-Mean of X)\***  **(Y-Mean of y)** |
| 6061 | 81267 | -284291.375 | -1606187.625 | 80821585899.39 | 2579838686703.14 | 456625288419.23 |
| 641929 | 1591890 | 351576.625 | -95564.625 | 123606123246.39 | 9132597551.39 | -33598288326.89 |

**3. a. Summarized the following data by calculating the mean and standard deviation.**

**Note: You are advisable to use EXCEL. You are supposed to Copy the numbers (finalcalculations) from EXCEL and paste them into your word document.**

|  |  |  |  |
| --- | --- | --- | --- |
| **State** | **District** | **Number of Indigenous (Desi) Total Cattle** | **Total Buffalo** |
| **UTTARAKHAND** | **Uttarkashi** | **82991** | **25945** |
| **UTTARAKHAND** | **Chamoli** | **132165** | **37922** |
| **UTTARAKHAND** | **Rudraprayag** | **71277** | **31115** |
| **UTTARAKHAND** | **Tehri Garhwal** | **80833** | **79394** |
| **UTTARAKHAND** | **Dehradun** | **87753** | **52185** |
| **UTTARAKHAND** | **Garhwal** | **235412** | **30076** |
| **UTTARAKHAND** | **Pithoragarh** | **108417** | **37056** |
| **UTTARAKHAND** | **Bageshwar** | **70863** | **31432** |
| **UTTARAKHAND** | **Almora** | **132038** | **77444** |
| **UTTARAKHAND** | **Champawat** | **45506** | **18599** |
| **UTTARAKHAND** | **Nainital** | **101009** | **77759** |
| **UTTARAKHAND** | **Udham Singh Nagar** | **63311** | **152911** |
| **UTTARAKHAND** | **Hardwar** | **63728** | **214480** |

**Data Source: Ministry of agriculture and farmers’ welfare.**

**3. b. Write about the general pattern (here, time series component) across the given years usingan appropriate graph.**

**Note: You may use EXCEL, Tableau, Power BI Etc. for creating Graph**

**PLEASE CHECK THE TABLE BELOW**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Pro duc tivi ty Gro und nut (Kg ./he ctar e)** | **Prod uctiv ity Rape seed & Must ard (Kg./ hecta re)** | **Year** | **Prod uctiv ity Grou ndnu t (Kg./ hecta re)** | **Prod uctiv ity Rape seed & Must ard (Kg./ hecta re)** | **Year** | **Prod uctiv ity Grou ndnu t (Kg./ hecta re)** | **Prod uctiv ity Rape seed & Must ard (Kg./ hecta re)** | **Year** | **Produ ctivit y Grou ndnut (Kg./ hectar e)** | **Produ ctivit y Rapes eed& Musta rd (Kg./ hectar e)** |
| **1950-51** | **775** | **368** | **1968-69** | **653** | **469** | **1986-87** | **841** | **700** | **2003-04** | **1357** | **1159** |
| **1951-52** | **649** | **393** | **1969-70** | **720** | **493** | **1987-88** | **855** | **748** | **2004-05** | **1020** | **1038** |
| **1952-53** | **611** | **408** | **1970-71** | **834** | **594** | **1988-89** | **1132** | **906** | **2005-06** | **1187** | **1117** |
| **1953-54** | **811** | **389** | **1971-72** | **823** | **396** | **1989-90** | **930** | **831** | **2006-07** | **866** | **1095** |
| **1954-55** | **766** | **425** | **1972-73** | **585** | **545** | **1990-91** | **904** | **904** | **2007-08** | **1459** | **1001** |
| **1955-56** | **752** | **336** | **1973-74** | **845** | **493** | **1991-92** | **818** | **895** | **2008-09** | **1163** | **1143** |
| **1956-57** | **783** | **411** | **1974-75** | **724** | **612** | **1992-93** | **1049** | **776** | **2009-10** | **991** | **1183** |
| **1957-58** | **734** | **387** | **1975-76** | **935** | **580** | **1993-94** | **941** | **847** | **2010-11** | **1411** | **1185** |
| **1958-59** | **828** | **426** | **1976-77** | **747** | **496** | **1994-95** | **1027** | **958** | **2011-12** | **1323** | **1121** |
| **1959-60** | **708** | **365** | **1977-78** | **866** | **460** | **1995-96** | **1007** | **916** | **2012-13** | **996** | **1262** |
| **1960-61** | **745** | **467** | **1978-79** | **835** | **525** | **1996-97** | **1138** | **1017** | **2013-14** | **1750** | **1188** |
| **1961-62** | **725** | **425** | **1979-80** | **805** | **411** | **1997-98** | **1040** | **668** | **2014-15** | **1400** | **1089** |
| **1962-63** | **695** | **417** | **1980-81** | **736** | **560** | **1998-99** | **1214** | **869** | **2015-16** | **1465** | **1183** |
| **1963-64** | **769** | **300** | **1981-82** | **972** | **541** | **1999-00** | **766** | **960** | **2016-17** | **1398** | **1304** |
| **1964-65** | **814** | **507** | **1982-83** | **732** | **577** | **2000-01** | **977** | **935** | **2017-18** | **1893** | **1410** |
| **1965-66** | **554** | **446** | **1983-84** | **940** | **673** | **2001-02** | **1127** | **1002** | **2018-19** | **1422** | **1511** |
| **1966-67** | **604** | **408** | **1984-85** | **898** | **771** | **2002-03** | **694** | **854** | **2019-20** | **2063** | **1331** |
| **1967-68** | **759** | **483** | **1985-86** | **719** | **674** |  |  |  | **2020-21** | **1676** | **1511** |

**Answer: a) Calculation of mean and standard deviation of Number of Indigenous (Desi) Total Cattle**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **State** | **District** | **Number of Indigenous**  **(Desi) Total Cattle (X)** | **dx = X – Mean of X** | **dx^2** |
| UTTARAKHAND | Uttarkashi | 82991 | -15109 | 228281881 |
| UTTARAKHAND | Chamoli | 132165 | 34065 | 1160424225 |
| UTTARAKHAND | Rudraprayag | 71277 | -26823 | 719473329 |
| UTTARAKHAND | Tehri Garhwal | 80833 | -17267 | 298149289 |
| UTTARAKHAND | Dehradun | 87753 | -10347 | 107060409 |
| UTTARAKHAND | Garhwal | 235412 | 137312 | 18854585344 |