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**Department of Statistics**

**College of administration and Economics**

**University of Salahaddin-Hawler**

**Subject: Time Series**

**Course Book – 3rd Year**

**Lecturer's name: Hunar Adam Hamza-(MSc)**

**Academic Year: 2023/2024**

**Course Book**

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| **1. Course name** | **Time Series**  |
| **2. Lecturer in charge** | **Hunar Adam Hamza** |
| **3. Department/ College** | **Statistics and informatics/Administration and Economics** |
| **4. Contact** | **e-mail: Hunar.Hamza@su.edu.krd** |
| **5. Time (in hours) per week**  | **Theory: 3****Practical: N/A**  |
| **6. Office hours** | **Sunday: 11:30-2:30 & Tuesday: 9:30-12:30** |
| **7. Course code** |  |
| **8. Teacher's academic profile**  | **My professional journey commenced as an assistant researcher in the Department of Statistics at the University of Salahaddin's College of Administration and Economics, where I held this position from 2007 to 2011. During this tenure, I concurrently embarked on a Master of Applied Statistics, which I successfully completed at Swinburne University of Technology in Australia in 2014. My teaching experience encompasses a diverse range of courses, including Principles of Statistics, Visual Basic, SPSS, Time Series, Set Theory, and Probability.** |
| **9. Keywords** | **Component of time series , differencing , LSD**  |
| **10. Course overview:**  **Time series data is prevalent in various fields, including business, meteorology, agriculture, biology, and ecology. These data are collected over time and can represent various aspects, such as stock prices, temperatures, crop yields, heart activity, and animal abundance. Time series analysis aims to uncover the underlying patterns and mechanisms that govern these data and forecast future values based on historical trends and related factors.** |
| **11. Course objective:****There are two main goals of time series analysis: identifying the nature of the phenomenon represented by the sequence of observations, and forecasting (predicting future values of the time series variable)** |
| **12. Students obligation in the classroom:*** **Punctuality: Arrive on time for each class session.**
* **Preparedness: Bring your lecture notes to every class.**
* **Quiz Attendance: Missing a quiz will result in a zero score.**
* **Timely Submissions: Submit your homework assignments on time.**
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| **13. Forms of teaching****The course employs a variety of teaching approaches, incorporating PowerPoint slides to emphasize essential points and whiteboards to facilitate interactive learning. Students are actively involved in discussions, sharing their perspectives with their peers. To enhance comprehension, students are provided with lecture handouts at the beginning of each session, ensuring they are well-versed in the upcoming material.** |
| **14. Assessment scheme****Midterm exam: 30 % marks.****Class assignments & quizzes: there will be weekly class assignments and quizzes;10 % marks.****There will be extra assignments, which give the students extra marks.****Final exam: 60 % marks**.**The examination schedule will be announced by the exam board of the department of statistics**. |
| **15. Student learning outcome:*** **Define time series components.**
* **Explain time series with different structures.**
* **Explain trend, seasonality, cyclical irregularity.**
* **Explain stochastic components.**
* **Describe and use difference and lag operators.**
* **Construct stationary time series model.**
* **Explain and interpret AR models.**
* **Explain and interpret MA models.**
* **Explain and interpret ARMA models**
* **evaluate stationary in time series.**
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| **16. Course Reading List and References‌:****Box, G.E.P. Jenkins G.M.(2014): “ Time Series Analysis Forecasting and Control ”, San Francisco, Holden day, U.S.A.****Hamilton, James. D. (2018): “ Time Series Analysis ”, published by prniction university press, U.S.A.****Montgomery, Douglas C. ; Jennings, Cheryl L. ; Kulahci, Murat (2008): “ Introduction to time series Analysis and Forecasting”, Hoboken, New jersey , U.S.A.** |
| **17. The Topics:** | **Lecturer's name** |
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| **CHAPTER ONE** |
| 1. Time series data
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| 1. Time Series Analysis
 |
| 1. Data Patterns
 |
| * 1. Trend
 |
| * 1. Periodic Fluctuations
 |
| * + 1. Seasonal Variations
 |
| * + 1. Cyclic Variations
 |
| * 1. Random or Irregular Movements
 |
| 1. Index Numbers
 |
| 1. Price index
 |
| * 1. Simple Price Index
 |
| * 1. Simple Average Price Index
 |
| * 1. Weighted Average Price Index
 |
| * + 1. Laspeyres price index:
 |
| * + 1. Paasche price index
 |
| 1. Time Series Decomposition
 |
| 1. Time Series Model
 |
| * 1. Additive Model for Time Series Analysis
 |
| * 1. Multiplicative Model for Time Series Analysis
 |
| 1. STATIONARY TIME SERIES
 |
| 1. TRANSFORMATIONS
 |
| 1. Forecast Accuracy
 |
| **CHAPTER TWO** |
| 1. Time Series Smoothing
 |
| 1. Moving average
 |
| * 1. Simple Moving Average (SMA)
 |
| * 1. Weighted Moving Average
 |
| * 1. Exponential Moving Average (EMA)
 |
| **CHAPTER THREE** |
| Methods of Measuring the Trend |
| 1. Graphic Method.
 |
| 1. Method of Semi-Averages
 |
| 1. Least Square Method
 |
| **CHAPTER FOUR** |
| 1. Seasonal variation
 |
| 1. Measurement of seasonal variations:
 |
| 1. Detecting seasonality
 |
| * 1. Method of simple averages.
 |
| * 1. Ratio to Moving Average Method
 |

 | **Hunar Adam Hamza** |
| **18. Practical Topics (If there is any)** |  |
| **Q1//** Consider the following data set consisting of 12 observations taken over time:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| $$y\_{t}$$ | 71 | 70 | 69 | 68 | 64 | 65 | 72 | 78 | 75 | 75 | 75 | 70 |

Find the following:1. Moving Average 3
2. Moving Average 3 with weighted 0.1, 0.3, and 0.6.
3. Exponential smoothing with $α=0.2.$

**Q2//** If we have the following data production.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| years | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
| $$y\_{t}$$ | 6 | 4 | 6 | 5 | 9 | 7 | 12 | 10 | 14 | 13 |

**Required:** 1. Find trend equation (estimation model) by use least square method (LSD).
2. Draw trend line by use estimate model.

**Q3//** The table below gives the quarterly sales of a retail giant for the years 2008-2010.

|  |  |
| --- | --- |
| years | quarters |
| I | II | III | IV |
| 2008 | 20 | 30 | 39 | 60 |
| 2009 | 40 | 51 | 62 | 81 |
| 2010 | 50 | 64 | 74 | 95 |

Find // 1. Using the ratio to moving average method, calculate seasonality adjusted indices for each quarter.
2. Obtain a regression line equation representing the above data.
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| **20. Extra notes:**The college's exam board will decide the structure and content of the final exam. Please be aware that the syllabus is subject to modifications, and the actual time required to complete the course may vary. |
| **21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ**   |