1 MSc in Applied Statistics and Data Science Program

1.1 Mission

Provide professional preparations, involving the use of data analysis to identify appropriate strategies in various real-life problems and statistical methodology to develop data-driven solutions to management challenges, to pursue a career in the domain.

1.2 Goals

- **Promote applied scientific research particularly that are related to requirements of the kingdom in Applied Statistics and Data Analysis.**
- **Produce world-class graduates with a broad-based and global outlook able to work both within the kingdom and beyond.**
- **Provide students with the theoretical knowledge and practical methods and skills needed to begin or enhance careers as data analysts in the industry.**
- **Train graduates with an adequate understanding of the markets, creating, evaluating, and using appropriate methods, algorithms, and software to be able to:**
  - **Apply computing theory, languages, and algorithms, as well as statistical models to appropriately formulate and interpret data.**
  - **Understand at an advanced level, statistical concepts, and techniques to apply them to cross-sectional, time-series, longitudinal and event-oriented data sets.**
  - **Formulate and use appropriate models of data analysis to solve hidden solutions to business related challenges.**
  - **Develop an advanced knowledge of statistical inference and stochastic processes, statistical modeling, and data analysis to solve problems in engineering, computing and communications sciences, medicine natural and environmental sciences, health and social sciences, economics, and finance.**
  - **Analyze and interpret data, synthesize information to provide valid conclusions.**
  - **Visualize, curate, and prepare data for use with a variety of statistical methods and models and recognize how the quality of the data and the means of data collection may affect conclusions.**
  - **Develop a professional skill in consulting aspects in different subfields of statistics and data science such as Biometrics, Statistics and Data Science for Social, Behavioral and Educational Sciences, Statistics and Data Science for Business, Statistics and Data Science for Industry, Official Statistics.**
  - **Raise the efficiency of those enrolled in analysis positions in the public and private sectors by developing their skills in using statistical methods, algorithms, and software within the business and management sectors.**

1.3 Graduate Attributes

Graduate attributes for which MSc in Applied Statistics and Data Science students are prepared are as follows:

- **Profound background in postgraduate-level statistics and data science.**
- **Use appropriate knowledge and skills to identify, formulate, analyze, and solve complex scientific problems.**
- **Work effectively either independently or as a member of a team.**
- **Communicate complex mathematical and statistical concepts within the community and with society at large.**
- **Apply professional ethics, accountability, and equity.**
- **Able to identify and address his/her own educational needs to maintain competence for adapting to new needs and environment.**

1.4 Student Admission

The department of Mathematics is committed to the Standard List of Postgraduate Studies at the Saudi Universities and its Executive Regulations at King Khalid University. And especially, Article 15 for the entrance exam, and Article 18 for the complementary courses. Particularly, the department requires:

- **A bachelor's degree in Science or Engineering or Business.**
- **Basic background in calculus, probability theory, statistics, linear algebra, and differential equations. If needed candidate is advised to take complementary course in any course of these basic background. This will be determined by a departmental committee based on each candidate circumstances.**
- **Intermediate level in English verified through one of the following**

Test	Required level
TOEFL-PBT	450
TOEFL-CBT	133
TOEFL-IBT	45
STEP	67
IELTS	4

1.5 Program Learning Outcomes

Knowledge and understanding	
K1	State statistical reasoning, in exploratory data analysis by graphical and other software tools
K2	Describe the features of the statistical methods involved in Data Science.
K3	Memorize statistical models and their data science algorithms used in big data analysis.
K4	Identify appropriate software package in dealing with database management
K5	Develop solid knowledge in a broad range of methods based on statistics and informatics and can use these for data management, analysis and problem solving
Skills	
S1	Retrieve specific information from the statistical theory, critically evaluate technical articles, and manage many types of any type of data.
S2	Apply computing theory, languages, and algorithms, as well as statistical models, to appropriately formulate and use data analyses
S3	Explain the statistical properties to evaluate statistical models of data to forecast trends and predict outcomes in a variety of industries including scientific and commercial sector
S4	Demonstrate good understanding of statistical concepts and their implantation in data science
S5	Use and adapt statistical software packages and scalable computing infrastructure to formulate problems, identify and gather relevant existing data, and analyze the data to provide insights
S6	Utilize contemporary computing technologies, such as machine learning, AI, parallel and distributed computing, to solve practical problems characterized by large-scale data.
Values	
V1	Work effectively, both independently and as part of an interdisciplinary group.
V2	Take full responsibility for initiating, identifying, amending, and achieving aims and desired outcomes, using new skills/ techniques as required.
V3	Able to articulate awareness of and demonstrate personal characteristics that positively impact the workplace and reflect integrity and professional and academic values when dealing with various issues.

1.6 Teaching and Learning Strategies to Achieve Program Learning Outcomes

- **Disseminate up-to-date knowledge via:**
  lectures, up-to-date textbooks, hand-outs, develop skills in using library and other learning resources, use of the Internet.
- **Develop the capability to use ideas and information via:**
  case studies, practicals, projects, demonstrations, group working, simulations (e.g., computer based), problem-solving, discussion and debate, essay-writing.
- **Develop the students' ability to test ideas and evidence via:**
  seminar and tutorials, supervision, presentations, essays, feedback on written work, literature reviewing, exam papers, critical assessment, peer assessment, self-assessment.
- **Develop the student's ability to generate ideas and evidence via:**
  research projects, workshops on techniques of creative problem solving, group working, lateral thinking, brainstorming, Mind-mapping, problem solving
- **Facilitate the personal development of students via:**
  feedback, experiential learning, learning logs, structured experiences in groups, selfassessment, profiling.
- **Develop the capacity of students to plan and manage own learning via:**
  projects, workshops, mentors, independent study, dissertations, work placement, portfolio development

1.7 Thesis and its Requirements

Not Applicable

1.8 Study Plan

Course Code	Course Title	Prerequisite Courses	Credit Hours
Level 1			
Mandatory			
STAT6800	Fundamental Concepts of Probability and Statistics		3
STAT6801	Data Management and Visualization		3
STAT6802	Statistical Software		4
MATH****	Optional course 1		3
Total credit hours			13

Level 2			
Mandatory			
STAT6803	Probability Models and Statistical Computing		3
STAT6804	Experimental Design		3
STAT6805	Sampling Methods		3
STAT****	Optional course 2		3
Total credit hours			12
Level 3			
Mandatory			
STAT6806	Applied Multivariate Statistics Analysis		3
STAT6807	Applied Time Series Analysis		3
STAT6808	Demographic Methods		3
STAT****	Optional course 3		3
Total credit hours			12
Level 4			
Mandatory			
STAT****	Optional course 4		3
STAT****	Optional course 5		3
STAT6907	Graduation project		3
Total credit hours			9
Optional Courses			
MATH6801	Optimization Methods		3
MATH6802	Numerical Methods for Differential Equations		3
MATH6803	Applied Linear Models		3
STAT6809	Statistical Analysis of Reliability and Survival Data		3
STAT6810	Applied Nonparametric Statistics		3
STAT6811	Simulation and Monte Carlo Methods		3
STAT6812	Collecting and Analyzing Big Data		3
STAT6813	Bayesian Data Analysis		3
STAT6814	Actuarial Statistics		3
STAT6815	Neural Networks		3
STAT6816	Longitudinal Data Analysis		3

STAT6817	Meta-Analysis		3
STAT6818	Data Mining and Machine Learning		3
STAT6819	Web, Mobile and Enterprise Computing		3
STAT6820	Cloud Computing and Big data Analytics		3

Total credit hours for completing the program: 46 Hours.

2 Program Courses Short Description

2-1 Compulsory Courses

<table>
<tr><th colspan="6">Level 1</th></tr>
<tr><th>Level</th><th>Course Code</th><th>Course Title</th><th>Prerequisite Courses</th><th>Credit Hours</th><th>Level/year</th></tr>
<tr><td rowspan="4">1</td><td>STAT6800</td><td>Fundamental Concepts of Probability and Statistics</td><td></td><td>3</td><td>1/1</td></tr>
<tr><td colspan="5">Course general Description</td></tr>
<tr><td colspan="5">One of the fundamental purposes of the probability theory is the modeling of uncertainty. It permits to give the basic tools for many other areas in the mathematical sciences, including statistics, stochastic optimization, mathematical finance, or risk modeling. In comparison, inferential statistics' primary objective is to reconstruct an unknown characteristic of a population from a finite sample of this population. This issue allows to provide decision mechanisms in various domains such as commerce, economics, environmetrics, finance, security, reliability. This course deals with fundamental aspects of both branches.</td></tr>
<tr><td colspan="5">Essential References
▪ Roussas, G. A Course in Mathematical Statistics, Academic Press. 1997.
▪ R. Durrett, Probability: Theory and Examples, Duxbury Press, 1996
▪ Lehmman, E. " Theory of Point Estimation", Springer, 1995.</td></tr>
<tr><th>Level</th><th>Course Code</th><th>Course Title</th><th>Prerequisite Courses</th><th>Credit Hours</th><th>Level/year</th></tr>
<tr><td rowspan="3">1</td><td>STAT6801</td><td>Data Management and Visualization</td><td></td><td>3</td><td>1/1</td></tr>
<tr><td colspan="5">Course general Description</td></tr>
<tr><td colspan="5">The management data is becoming a vital component of business decision-making. As demands change from customers and environmental conditions, businesses must react to these changes quickly. The essential factors in business decision-making are managing data in a relational database system and turning that data into information after being processed to add context, reliance, and purpose. This course gives an overview of different tools that deal with the integration and management of big data. It allows to familiarize students with principal Database Management Systems, including SQL Server, Oracle, DB2, MySQL, etc.
Essential References</td></tr>
</table>

- Baumer, Kaplan, Horton, Modern Data Science with R, CRC Press, 2017
- Powell, Frank Miller - Wiley Pathways Introduction to Database Management-Wiley (2007)
- Chad R. Adams, Learning Python Data Visualization: Master how to build dynamic HTML5-ready SVG charts using Python and the pygal library, Packt Publishing, 2014

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
1	STAT6802	Statistical Software		4	1/1

Course general Description

The main goal of this course is to introduce students to the basic concepts and ideas of a statistical computing. In particular, it aims to train students in programming tools using the R computing statistics, Python, SPSS/SAS to provide computational skills which will support other M-level courses, and to introduce students to fundamental concepts in (scientific) programming in general.

Essential References

- Alain F. Zuur, Elena N. Ieno, Erik Meesters, A Beginner's Guide to R-Springer-Verlag New York, 2009.
- David J. Pine, Introduction to Python for Science and Engineering, CRC Press, Tylor & Francis Group, 2019.
- Delwiche and Slaughter: The Little SAS Book, 5th edition
- Andy Field, Discovering Statistics Using SPSS, 5th edition

Level 2

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
2	STAT6803	Probability Models and Statistical Computing		3	2/1

Course general Description

Computational statistics is a branch of mathematical sciences concerned with efficient methods for obtaining numerical solutions to statistically formulated problems. This course covers probability models, with emphasis on Markov chains. Theoretical results will be stated, and the focus is on modeling. The last part of the course is devoted to techniques and simulation methods, with emphasis on statistical design and interpretation of results. Students will work in team projects with a programming component.

	Essential References				
	▪ **G.M. Cochard - Introduction to stochastic processes and simulation-Wiley (2019).**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
2	**STAT6804**	**Experimental Design**		**3**	**2/1**
	Course general Description				
	An experimental design is a crucial part of data analysis in any field. It is indispensable in some areas, including business, medicine, or engineering. Of course, its role is justified by the fact that any efficient use of the data requires some prior experiments. In this course, students will learn about basic experimental design, including block and factorial designs, and commonly used statistical tests, such as the t-tests and ANOVAs.				
	Essential References				
	▪ **Montgomery, D. C. Design and Analysis of Experiments, 10th Edition, John Wiley, 2019.**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
2	**STAT6805**	**Sampling Methods**		**3**	**2/1**
	Course general Description				
	This course aims to cover sampling methods that would be useful for research and management in many fields. A well-designed sampling procedure ensures that we can summarize and analyze data with a minimum of assumptions and complications. This course allows to familiarize students with this fundamental aspect of applied statistics.				
	Essential References				
	▪ **Steven K. T. Sampling, 3rd.ed., Wiley, 2012.**				
Level 3					
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
3	**STAT6806**	**Applied Multivariate Statistics Analysis**		**3**	**1/2**
	Course general Description				
	The Multivariate statistical methods allow to model and analyze several variables simultaneously. Motivated by its useful applications to various applied fields, this branch of statistics has become an attractive topic in modern statistics. This course's main goal is to familiarize students with the theoretical and practical aspects of multivariate statistics and high dimensional statistical inference.				

	Essential References				
	▪ **W. Härdle and L. Simar, Applied Multivariate Statistical Analysis, Springer-Verlag Berlin Heidelberg, 2007.**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
3	**STAT6807**	**Applied Time Series Analysis**		**3**	**1/2**
	Course general Description				
	Time-series data arise in many applied fields, including finance, economics, medicine, signal processing, and speech recognition. The main feature in the time series is the dependency correlation of the data. Thus, the classical standard methods are not appropriate, and special methods for statistical analysis are needed. This course's main goal introduces the theory and practice of time series analysis and gives a survey on the different time series models.				
	Essential References				
	▪ **P. Brockwell and R. Davis. Time Series: Theory and Methods. Springer, New York,1998**.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
3	**STAT6808**	**Demographic Methods**		**3**	**1/2**
	Course general Description				
	This course introduces the basic techniques of demographic analysis. In this course, graduates will become familiar with the sources of data available for demographic research. Many important topics will be presented and explored, including population composition and change measures, measures of mortality, fertility, marriage, migration levels and patterns, life table, standardization, and population projection techniques.				
	Essential References				
	▪ **Kenneth W. Wachter - Essential Demographic Methods (2006)**.				
Level 4					
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
4	**STAT6907**	**Research project**		**3**	**2/2**
	Course general Description				

	This course aims to further develop an approved proposal of research, based on the feedback provided by the program committee and the continuing guidance of the assigned supervisor.
	Essential References
	Relevant textbook(s) will be selected by the supervisor chosen by the Program Committee at the department. Additional bibliography to be compiled by individual student based on the specific study area, with guidance from supervisor.

2-2 Optional Courses

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
1	MATH6801	Optimization Methods		3	1/1
	Course general Description				
	This course presents the problem of static optimization, with and without (equality and inequality) constraints, both from the theoretical (optimality conditions) and methodological (algorithms) point of view. Economics and financial applications are provided. Dynamic optimization is also introduced.				
	Essential References				
	▪ **A. K. Dixit, "Optimization in Economic Theory", Oxford University Press, 2nd Ed. (1990).** ▪ **P. Brandimarte, "Numerical Methods in Finance and Economics: A MATLAB-Based Introduction" Wiley-Interscience, 2nd Ed. (2006).**				

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
1	MATH6802	Numerical Methods for Differential Equations		3	1/1
	Course general Description				
	This course will introduce the graduate to numerical methods for solving ordinary differential equations (ODEs) and stochastic differential equations (SDEs). We will concentrate on finite difference methods and their application to standard model problems. This will allow the methods to be learn in simple terms while at the same time treating such concepts as accuracy and stability with a reasonable degree of mathematical reasoning.				
	Essential References				

	▪ Iserles, A first course in the numerical analysis of differential equations, 2nd edition, Cambridge University Press, 2009.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
1	MATH6803	Applied Linear Models			1/1
	Course general Description				
	Statistical analysis is a crucial tool to model the random phenomena in various areas such as medicine, agriculture, business, economics, psychology, genetics, criminology, and social sciences. The main aim of this course is to emphasize the practical aspect of some statistical models. It covers the principal models of the prediction issues, such as linear regression, multiple linear regression, generalized linear models, nonlinear regression models, and survival analysis models.				
	Essential References				
	Sanford W. Applied linear regression, Wiley 2005.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6809	Statistical Analysis of Reliability and Survival Data		3	
	Course general Description				
	Reliability and Survival Data Analysis concerning the statistical modeling of data comes from both energy and biomedical data. Precisely, reliability analysis is used in the engineering domain, whereas survival analysis is usually employed for medical data. This course aims to give an overview of statistical models that fit disease risk assessment, school dropout, and product liability, among others. We will also discuss descriptive methods of survival data, Kaplan-Meiers curves, regression models for survival data, and accelerated failure time models. The practical component of this course will be performed using R-software.				
	Essential References				
	▪ David W. Hosmer, Jr., Stanley L., Susanne M. Applied Survival Analysis: Regression Modeling of Time to Event Data, Willy, 2008.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6810	Applied Nonparametric Statistics		3	
	Course general Description				
	The main feature of the nonparametric approach is the fact that its statistical analysis is not based on the shape of the model, unlike the parametric procedure, where the shape is a fundamental assumption. This feature allows to cover many practical situations. This course introduces students to a wide range of interesting				

	nonparametric ideas in statistics. It provides an overview of many distribution-free statistical models such as order statistics, quantiles, cumulative function, density function and its derivatives.				
	Essential References				
	▪ **Z. GOVINDARAJUJU, Nonparametric Inference, World Scientific Publishing Co. Pte. Ltd, 2007**.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6811	**Simulation and Monte Carlo Methods**		**3**	
	Course general Description				
	Monte Carlo methods are numerical methods that use pseudo numbers to simulate random phenomena. This is typically done by creating a random variable whose expected value is the desired quantity. When simulate and tabulate the random variable, its sample mean and variance are used to construct probabilistic estimates. This course will introduce students to a variety of techniques of Monte Carlo methods to generate the pseudo-number. This course covers the basic Monte Carlo integration, as well as bootstrap methodology. The hope is that a significant portion of the course will be spent in the computer lab, using the statistical software R to perform Monte Carlo simulations.				
	Essential References				
	▪ **Christian P. Robert, George C., Monte Carlo Statistical Methods. Springer, New York (1999).**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6812	**Collecting and Analyzing Big Data**		**3**	
	Course general Description				
	The importance of statistical models is motivated over the past decades by the volume and complexity of collected data. This course introduces the basic tools for collecting and analyzing Big data. Students will learn how to analyze large data sets and identify patterns to improve any company and organization decision-making process. It is designed as a practical overview. The course will provide an overview of different software in big data analysis.				
	Essential References				
	▪ **Marin, I.; Shukla, A. Big Data Analysis with Python, Packt Publishing, 2019.**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6813	**Bayesian Data Analysis**		**3**	

	Course general Description				
	This course introduces the Bayesian approach and models, and their practical use in data analysis. We will discuss model choice, including the assessment of prior distributions. This course familiarizes students with Bayesian inference, through posterior means, credible intervals and hypothesis testing. The computational analyses will be performed using some R-packages such as rjags R2jags and Rstan, among others.				
	Essential References				
	▪ **Andrew G., John B. Carlin, Hal S. Stern, Donald B. Rubin, Bayesian Data Analysis, Chapman and Hall, 2003**.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6814	**Actuarial Statistics**		**3**	
	Course general Description				
	This course covers survival models and their estimation, as well as applications in insurance and finance. It concentrates on the concept of survival models and actuarial notation. Among the survival models developed in this course: the binomial model of mortality and its estimation, models with transition intensities depending on age and duration, analysis of mortality/morbidity and the main forms of selection, models for the projection of mortality. A data analysis using numerical computer packages will be developed during the course in addition to the theoretical study.				
	Essential References				
	▪ **Dale S. B. and Arnold F. S. Financial and Actuarial Statistics: An Introduction, Second Edition, Chapman and Hall/CRC, Year: 2013.**				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**
	STAT6815	**Neural Networks**		**3**	
	Course general Description				
	This course introduces the basic neural models, neural network algorithms, and their applications. It also introduces fundamental techniques and principal features of neural computation and the common models and their implementation in practice. By completing this course, graduates will be able to use neural networks to solve complex problems linked to pattern recognition, function approximations, data visualization, etc.				
	Essential References				
	▪ **K. Gurney, An Introduction to Neural Networks, UCL Press, London, 1997**.				
Level	**Course Code**	**Course Title**	**Prerequisite Courses**	**Credit Hours**	**Level/year**

	STAT6816	Longitudinal Data Analysis		3	
	Course general Description				
	This course provides an overview of principal statistical methods and/or models of longitudinal data analysis. It contains the key theoretical models as well as their implementation in R and SAS. Upon completing the course, students will have a comprehensive knowledge and understanding of the properties of modern methods for longitudinal data analysis, pose scientific questions within the context of appropriate statistical models and carry out and interpret the analysis results.				
	Essential References				
	▪ Fitzmaurice, G.M., Laird, N.M., and Ware, J.H. Applied Longitudinal Analysis, 2nd edition. New York: Wiley, 2011.				

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
	STAT6817	Meta-Analysis		3	
	Course general Description				
	Meta-analysis consists of a collection of techniques that attempt to analyze and integrate effect sizes (indices of the association between an independent variable and a dependent variable) that accrue from research studies. The course concerns how to conduct a meta-analysis and how to interpret the results. The focus of this course will on: - Reading a textbook on how to conduct such analyses, - Reading and critiquing applications of meta-analysis, - Conducting original (small size) meta-analyses in areas of interest to students, and - Reading and discussing primary research that applies, develops, or critiques meta-analysis.				
	Essential References				
	▪ Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). Introduction to meta- analysis. Chichester, UK: Wiley.				

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
	STAT6818	Data Mining and Machine Learning		3	
	Course general Description				
	This course introduces Data Mining process, Machine Learning and how to implement Machine Learning algorithms in Data Mining. This course is designed to provide information in a simple and straight forward way so ease learning methods. It will start from scratch and keep building the knowledge step by step until becoming familiar with the most used Machine Learning algorithms.				

	Essential References
	▪ **M. J. Zaki & W. Meira, "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", 2nd Ed., Cambridge University Press (2020).**

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
	STAT6819	**Web, Mobile and Enterprise Computing**		**3**	
	Course general Description				
	This course introduces the fundamentals and working knowledge in the application of enterprise computing in the running and operation of a company-wide and enterprise-wide business. It has the goal to develop the student ability to produce e-solutions.				
	Essential References				
	▪ **D. Kroenke, D. Auer, S. Vandenberg, & R. Yoder, "Database Concepts", 8th Ed., Pearson (2019).**				

Level	Course Code	Course Title	Prerequisite Courses	Credit Hours	Level/year
	STAT6820	**Cloud Computing and Big data Analytics**		**3**	
	Course general Description				
	This course introduces the theoretical concepts, leading-edge techniques and practical tools involved in the latest multi-disciplinary approaches addressing the challenges of big data. Addressed topics and features in the course includes: advances in theoretical aspects of big data, predictive analytics, and cloud-based architectures; applications and implementations that utilize big data in cloud architectures; real-world applications of algorithms and techniques to address the challenges of big datasets.				
	Essential References				
	▪ **M. Trovati, R. Hill, A. Anjum, S. Y. Zhu, L. Liu, "Big-Data Analytics and Cloud Computing: Theory, Algorithms and Applications", Springer International Publishing (2015).**				