

DEPARTMENT OF MANAGEMENT SCIENCE AND STATISTICS

Mission Statement

The mission of the Department of Management Science and Statistics is to offer both undergraduate and graduate educational programs that are of high quality and meet the changing needs of the global community; to provide a supportive learning environment for students; to foster the success of our students in their professional careers; and to create an academic environment that stresses excellence in teaching, intellectual contributions, and service. The Department contributes to the missions of the College and the University through research and education in the quantitative sciences. Theory and analysis are applied to a variety of interdisciplinary problems to discover new approaches for meeting the challenges of decision making in a global arena of expanding technology and information.

Department Information

The disciplines of Management Science and Statistics are integral to modern decision-making processes. These interdisciplinary fields emphasize the use of quantitative methods and computers for analyzing, understanding, visualizing, and interpreting data. Management Science seeks to provide a rational basis for decision analysis across a broad spectrum of business functions such as production/operations, marketing, finance, human resources, project management, logistics, and supply chain management. Statistical methods provide analytical tools for research in high-technology and biomedical industries, insurance, and government agencies. Both disciplines offer the opportunity to pursue advanced graduate studies. The Department of Management Science and Statistics offers a Bachelor of Business Administration (B.B.A.) degree in Actuarial Science, a B.B.A. degree in Business Analytics, a B.B.A. degree in Operations and Supply Chain Management (two tracks), and a Bachelor of Science (B.S.) degree in Statistics and Data Science. The department also offers minors in Actuarial Science, Operations and Supply Chain Management, and Statistics, which are open to all majors in the University. In addition, certificates are offered in Business Analytics, and Operations and Supply Chain Management.

- B.B.A. degree in Actuarial Science (p. 1)
- B.B.A. degree in Business Analytics (p. 3)
- B.B.A. degree in Operations and Supply Chain Management (p. 6)
- B.S. degree in Statistics and Data Science (p. 9)
- Accelerated M.S. in Statistics and Data Science (p. 11)

Bachelor of Business Administration Degree in Actuarial Science

Actuarial Science is a discipline that uses mathematics and statistical models to assess, manage risk, and solve emerging financial and social problems. Graduates' unique blend of analytical and business skills are especially valuable in the insurance and financial services industry. They apply their skills to calculations in life, health, social, and casualty insurance; annuities; and pensions. Traditionally, they have been involved in developing probability tables for natural disasters, unemployment, etc. There is an increasing need for trained actuaries in the insurance industry. The Bachelor of Business Administration (B.B.A.) in Actuarial

Science provides students the opportunity to acquire the quantitative and business skills to prepare them for a career as an actuary. The minimum number of semester credit hours for the B.B.A. degree in Actuarial Science is 120, at least 39 of which must be at the upper-division level.

All candidates seeking this degree must fulfill the Core Curriculum requirements, the Common Body of Knowledge (CBK) requirements, and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.B.A. degree in Actuarial Science must fulfill University Core Curriculum requirements. The two courses listed below satisfy both degree requirements and Core Curriculum requirements.

MAT 1213 should be used to satisfy the core requirement in Mathematics (020). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

All degrees in the Carlos Alvarez College of Business require 120 hours. If students elect to take a course that satisfies both a Core and College requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Common Body of Knowledge (CBK)

All students seeking a B.B.A. degree in the Carlos Alvarez College of Business must complete the following Common Body of Knowledge (CBK) courses in addition to the Core Curriculum.

ACC 2013	Principles of Accounting I	3
ACC 2033	Principles of Accounting II	3
ECO 2013	Introductory Macroeconomics	3
ECO 2023	Introductory Microeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement)	3
FIN 3013	Principles of Business Finance	3
GBA 2013	Legal, Social and Ethical Issues in Business	3
IS 1403	Business Information Systems Fluency	3
or IS 1413	Excel for Business Information Systems	
IS 3003	Principles of Information Systems for Management	3

MAT 1053	Mathematics for Business (satisfies Mathematics Core Curriculum requirement; this course is not required for Actuarial Science majors) ¹	3
MAT 1133	Calculus for Business (satisfies Mathematics or Component Area Option Core Curriculum requirement; Actuarial Science majors must take MAT 1213 in lieu of MAT 1133)	3
MGT 3003	Business Communication and Professional Development	3
MGT 3013	Introduction to Organization Theory, Behavior, and Management	3
MGT 4893	Management Strategy (taken in semester of graduation)	3
MKT 3013	Principles of Marketing	3
MS 1023	Business Statistics with Computer Applications I (Actuarial Science majors must take STA 3003 in lieu of MS 1023)	3
MS 3043	Business Statistics with Computer Applications II (Actuarial Science majors must take STA 3513 in lieu of MS 3043)	3
MS 3053	Management Science and Operations Technology	3

Note: Students majoring in Actuarial Science, Economics, Finance, Operations and Supply Chain Management and Business Analytics are strongly encouraged to select IS 1413 Excel for Business Information Systems. IS 1413 is required for Accounting majors.

¹ Students may elect to substitute MAT 1093 Precalculus for MAT 1053 Mathematics for Business. Students electing to take MAT 1093 will need to meet prerequisites or achieve satisfactory performance on a placement examination. Visit UTSA Testing Services for more information regarding math placement exams.

In addition to the Core Curriculum requirements and requirements from the Carlos Alvarez College of Business Common Body of Knowledge (CBK), all candidates for the degree must complete the following degree requirements.

Degree Requirements

Code	Title	Credit Hours
A. Major Requirements		30
MAT 1223	Calculus II	
MAT 2213	Calculus III	
MAT 2233	Linear Algebra	
STA 3003	Statistical Methods and Applications	
STA 3513	Probability and Statistics	
STA 3523	Mathematical Statistics for Inference	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4643	Introduction to Stochastic Processes	
STA 4713	Applied Regression Analysis	
STA 4753	Time-Series Analysis	
STA 3003 and STA 3513 satisfy Business Common Body Knowledge requirements.		

B. Support Work 54

Business Common Body of Knowledge 48 CBK (MAT 1053 not required), (6 SCH satisfy core curriculum and 6 SCH satisfy major requirements)	
Select four courses from the following:	
FIN 4523	Introduction to Risk Management
FIN 4813	Property-Liability Insurance Finance
FIN 4823	Life and Health Insurance Finance
MS 3073	Business Intelligence and Analytics
STA 4233	Introduction to Programming and Data Management in R
STA 4243	Data Exploratory Methods with Python
STA 4903	Applied Survival Analysis
STA 4933	Internship in Statistics and Data Science
STA 4963	Actuarial Science Examination Preparation
Total Credit Hours	84

Course Sequence Guide for B.B.A. Degree in Actuarial Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

Recommended Four-Year Academic Plan

First Year		Credit Hours
Fall		
AIS 1233	AIS: Business (core)	3
IS 1403 or IS 1413	Business Information Systems Fluency (CBK) or Excel for Business Information Systems	3
WRC 1013	Freshman Composition I (core)	3
MAT 1213	Calculus I (core and CBK) ¹	3
American History (core)		3
Credit Hours		15
Spring		
WRC 1023	Freshman Composition II (core)	3
MAT 1223	Calculus II (major)	3
ECO 2023	Introductory Microeconomics (core and CBK) ¹	3
MGT 3003	Business Communication and Professional Development (CBK)	3
STA 3003	Statistical Methods and Applications (CBK)	3
Credit Hours		15
Second Year		
Fall		
ACC 2013	Principles of Accounting I (CBK)	3
ECO 2013	Introductory Macroeconomics (CBK)	3

MAT 2213	Calculus III (major)	3
STA 3513	Probability and Statistics (CBK)	3
Language, Philosophy & Culture (core)		3
Credit Hours		15

Spring

ACC 2033	Principles of Accounting II (CBK)	3
MAT 2233	Linear Algebra (major)	3
FIN 3013	Principles of Business Finance (CBK)	3
STA 3523	Mathematical Statistics for Inference (major)	3
Life & Physical Sciences (core)		3
Credit Hours		15

Third Year

Fall

MS 3053	Management Science and Operations Technology (CBK)	3
STA 4133	Introduction to Programming and Data Management in SAS (major)	3
STA 4643	Introduction to Stochastic Processes (major)	3
Component Area Option (core)		3
Government-Political Science (core)		3
Credit Hours		15

Spring

IS 3003	Principles of Information Systems for Management (CBK)	3
MGT 3013	Introduction to Organization Theory, Behavior, and Management (CBK)	3
MKT 3013	Principles of Marketing (CBK)	3
Upper-division FIN or STA Directed Elective (support work in major)		3
Creative Arts (core)		3
Credit Hours		15

Fourth Year

Fall

GBA 2013	Legal, Social and Ethical Issues in Business (CBK)	3
STA 4713	Applied Regression Analysis (major)	3
Upper-division FIN or STA Directed Elective (support work in major)		3
Upper-division FIN or STA Directed Elective (support work in major)		3
Government-Political Science (core)		3
Credit Hours		15

Spring

STA 4753	Time-Series Analysis (major)	3
MGT 4893	Management Strategy (CBK)	3
Upper-division FIN or STA Directed Elective (support work in major)		3
Life & Physical Sciences (core)		3

American History (core)	3
Credit Hours	15
Total Credit Hours	120

¹ Carlos Alvarez College of Business students should take MAT 1213 and ECO 2023 to satisfy both Core Curriculum and CBK requirements.

Bachelor of Business Administration Degree in Business Analytics

Solving problems and making decisions are integral parts of every organization's daily operations. Students will have the opportunity to develop and apply analytical models and to acquire essential quantitative and computer skills necessary to aid in solving problems in the increasingly technical business environments. The focus of this degree is on applications and appropriate software with a view toward how a manager can effectively apply quantitative models to improve the decision-making process.

The minimum number of semester credit hours required for the Bachelor of Business Administration (B.B.A.) in Business Analytics is 120, at least 39 of which must be at the upper-division level.

All candidates seeking this degree must fulfill the Core Curriculum requirements, the Common Body of Knowledge (CBK) requirements, and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.B.A. degree in Business Analytics must fulfill University Core Curriculum Requirements in the same manner as other students.

MAT 1053 and MAT 1133 should be used to satisfy the core requirement in Mathematics (020) and the core requirement in the Component Area Option (090). ECO 2023 should be used to satisfy the core requirement in social and Behavioral Sciences (080).

MAT 1053, MAT 1133, and ECO 2023 may be used to satisfy both Core Curriculum requirements and Common Body of Knowledge (CBK) requirements.

All degrees in the Carlos Alvarez College of Business require 120 hours. If students elect to take a course that satisfies both a Core and College requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3

Component Area Option	3
Total Credit Hours	42

Common Body of Knowledge (CBK)

All students seeking a B.B.A. degree in the Carlos Alvarez College of Business must complete the following Common Body of Knowledge (CBK) courses in addition to the Core Curriculum.

ACC 2013	Principles of Accounting I	3
ACC 2033	Principles of Accounting II	3
ECO 2013	Introductory Macroeconomics	3
ECO 2023	Introductory Microeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement)	3
FIN 3013	Principles of Business Finance	3
GBA 2013	Legal, Social and Ethical Issues in Business	3
IS 1403 or IS 1413	Business Information Systems Fluency Excel for Business Information Systems	3
IS 3003	Principles of Information Systems for Management	3
MAT 1053	Mathematics for Business (satisfies Mathematics Core Curriculum requirement; this course is not required for Actuarial Science majors) ¹	3
MAT 1133	Calculus for Business (satisfies Mathematics or Component Area Option Core Curriculum requirement; Actuarial Science majors must take MAT 1213 in lieu of MAT 1133)	3
MGT 3003	Business Communication and Professional Development	3
MGT 3013	Introduction to Organization Theory, Behavior, and Management	3
MGT 4893	Management Strategy (taken in semester of graduation)	3
MKT 3013	Principles of Marketing	3
MS 1023	Business Statistics with Computer Applications I (Actuarial Science majors must take STA 3003 in lieu of MS 1023)	3
MS 3043	Business Statistics with Computer Applications II (Actuarial Science majors must take STA 3513 in lieu of MS 3043)	3
MS 3053	Management Science and Operations Technology	3

Note: Students majoring in Actuarial Science, Economics, Finance, Operations and Supply Chain Management and Business Analytics are strongly encouraged to select IS 1413 Excel for Business Information Systems. IS 1413 is required for Accounting majors.

¹ Students may elect to substitute MAT 1093 Precalculus for MAT 1053 Mathematics for Business. Students electing to take MAT 1093 will need to meet prerequisites or achieve satisfactory performance on a placement examination. Visit UTSA Testing Services for more information regarding math placement exams.

In addition to the Core Curriculum requirements and requirements from the Carlos Alvarez College of Business Common Body of Knowledge

(CBK), all candidates for the degree must complete the following degree requirements.

Gateway Course

Students pursuing the B.B.A. degree in Business Analytics must successfully complete the business math gateway course MAT 1053 (TCCN MATH 1323) or equivalent with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete this course within two attempts, including dropping the course with a grade of "W" or by taking an equivalent course at another institution, will be required to change their major outside of business. **Upon the second failed attempt students will be changed to undeclared and will not be eligible for a Bachelor of Business Administration (B.B.A) or a Bachelor of Arts in Economics degree.**

Code	Title	Credit Hours
MAT 1053	Mathematics for Business	3

Degree Requirements

Code	Title	Credit Hours
A. Major Requirements		18

MS 3003	Visualization in Business Analytics	
MS 3073	Business Intelligence and Analytics	
MS 3083	Data Management for Business Analytics	
MS 3313	Statistical Modeling for Business Analytics	
MS 4203	Business Analytics Applications	
MS 4373	Data Mining for Business Analytics	

B. Support Work 69

Business Common Body of Knowledge (51 SCH) (9 SCH Satisfy Core Curriculum Requirements)

Select six courses from the following:

MS 4313	Six Sigma and Lean Operations	
MS 4323	Analytics with Spreadsheet and Simulation in Business	
MS 4343	Production/Operations Management	
MS 4353	Service Operations Management	
MS 4383	Predictive Operational Analytics	
MS 4543	Supply Chain Management	
MS 4923	Independent Study in Business Analytics	
MS 4943	Internship in Business Analytics	
MS 4963	Special Topics in Business Analytics	
IS 2053	Programming I	
IS 4023	Applied Big Data with Machine Learning	
STA 3313	Statistical Sampling	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4233	Introduction to Programming and Data Management in R	
STA 4243	Data Exploratory Methods with Python	
HTH 2623	Database Management in Community and Public Health	
FIN 3033	Principles of Investment	
FIN 3063	Computer Modeling of Financial Applications	

FIN 3423	Security Analysis and Corporate Valuation
FIN 4523	Introduction to Risk Management
FIN 4543	Credit Analysis
FIN 4553	Data Analytics in Finance
FIN 4573	Introduction to FinTech
FIN 4713	Mortgage Banking and Real Estate Finance
FIN 4723	Principles of Real Estate Investment
FIN 4853	Real Estate Appraisal
RFD 4743	Real Estate Decision Making
RFD 4773	Real Estate Data Analysis
MKT 3083	Marketing Research
MKT 4253	Digital Marketing
MKT 4453	Marketing Analytics
ECO 3033	Economics of Managerial Decisions
ECO 3113	Introduction to Mathematical Economics
ECO 3123	Introduction to Econometrics
ACC 3113	Accounting Information Systems
ACC 3163	Quantitative Analysis for Accountants
MGT 4613	Compensating Employees

Total Credit Hours **87**

Course Sequence Guide for B.B.A. Degree in Business Analytics

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

Recommended Four-Year Academic Plan

First Year

Fall		Credit Hours
AIS 1233	AIS: Business (core)	3
MAT 1053	Mathematics for Business (core and CBK)	3
WRC 1013	Freshman Composition I (core)	3
American History (core)		3
Life & Physical Sciences (core)		3
Credit Hours		15

Spring

MAT 1133	Calculus for Business (core and CBK) ¹	3
WRC 1023	Freshman Composition II (core)	3
ECO 2023	Introductory Microeconomics (core and CBK) ¹	3
IS 1403 or IS 1413	Business Information Systems Fluency (CBK) or Excel for Business Information Systems	3
ACC 2013	Principles of Accounting I (CBK)	3
Credit Hours		15

Second Year

Fall

ECO 2013	Introductory Macroeconomics (CBK)	3
MS 1023	Business Statistics with Computer Applications I (CBK)	3
MGT 3003	Business Communication and Professional Development (CBK)	3
IS 3003	Principles of Information Systems for Management (CBK)	3
ACC 2033	Principles of Accounting II (CBK)	3
Credit Hours		15

Spring

MS 3043	Business Statistics with Computer Applications II (CBK)	3
MS 3083	Data Management for Business Analytics (major)	3
MGT 3013	Introduction to Organization Theory, Behavior, and Management (CBK)	3
FIN 3013	Principles of Business Finance (CBK)	3
American History (core)		3
Credit Hours		15

Third Year

Fall

MS 3003	Visualization in Business Analytics (major)	3
MS 3053	Management Science and Operations Technology (CBK)	3
MS 3073	Business Intelligence and Analytics (major)	3
Upper-division Business elective (support work in major)		3
Life & Physical Sciences (core)		3
Credit Hours		15

Spring

MS 3313	Statistical Modeling for Business Analytics (major)	3
MKT 3013	Principles of Marketing (CBK)	3
Upper-division Business elective (support work in major)		3
Upper-division Business elective (support work in major)		3
Government-Political Science (core)		3
Credit Hours		15

Fourth Year

Fall

GBA 2013	Legal, Social and Ethical Issues in Business (CBK)	3
MS 4373	Data Mining for Business Analytics (major)	3
Upper-division Business elective (support work in major)		3
Upper-division Business elective (support work in major)		3
Government-Political Science (core)		3
Credit Hours		15

Spring

MS 4203	Business Analytics Applications (major)	3
MGT 4893	Management Strategy (CBK)	3
Upper-division Business Elective (support work in major)		3
Creative Arts (core)		3
Language, Philosophy & Culture (core)		3
Credit Hours		15
Total Credit Hours		120

¹ Carlos Alvarez College of Business students should take MAT 1053, MAT 1133, and ECO 2023 to satisfy both Core Curriculum and CBK requirements.

Bachelor of Business Administration Degree in Operations and Supply Chain Management

Solving problems and making decisions are integral parts of every organization’s daily operations. The discipline of Operations and Supply Chain Management focuses on the development and application of scientific and mathematical modeling to aid organizations in making these decisions. Students will have the opportunity to develop and apply analytical models and to acquire essential computer skills necessary in the increasingly technical business environments. Many organizations hire Operations and Supply Chain Management majors for managerial positions because of their computing skills and problem-solving abilities. These skills are essential in business environments that are seeking increased efficiency and productivity. The focus of this degree is on applications and appropriate software with a view toward how a manager can effectively apply quantitative models to improve the decision-making process.

The diverse courses offered provide students with an opportunity to specialize in professional fields such as operations and logistics. Thus, students have the option of emphasizing operations and logistics or using their breadth of marketable skills and abilities to solve problems in a variety of organizations and functional areas. The degree is designed to prepare students for careers in manufacturing, materials management, service operations, procurement, third party logistics, transportation processes, and management consulting. Since Operations and Supply Chain Management majors study a wide variety of topics dealing with daily activities and problems faced by managers in today’s ever-changing world, many career tracks are available to them. The minimum number of semester credit hours required for the Bachelor of Business Administration (B.B.A.) in Operations and Supply Chain Management is 120, at least 39 of which must be at the upper-division level.

All candidates seeking this degree must fulfill the Core Curriculum requirements, the Common Body of Knowledge (CBK) requirements, and the degree requirements, which are listed below.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.B.A. degree in Operations and Supply Chain Management must fulfill University Core Curriculum Requirements in the same manner as other students.

MAT 1053 and MAT 1133 should be used to satisfy the core requirement in Mathematics (020) and the core requirement in the Component Area Option (090). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

MAT 1053, MAT 1133, and ECO 2023 may be used to satisfy both Core Curriculum requirements and Common Body of Knowledge (CBK) requirements.

All degrees in the Carlos Alvarez College of Business require 120 hours. If students elect to take a course that satisfies both a Core and College requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Common Body of Knowledge (CBK)

All students seeking a B.B.A. degree in the Carlos Alvarez College of Business must complete the following Common Body of Knowledge (CBK) courses in addition to the Core Curriculum.

ACC 2013	Principles of Accounting I	3
ACC 2033	Principles of Accounting II	3
ECO 2013	Introductory Macroeconomics	3
ECO 2023	Introductory Microeconomics (satisfies Social and Behavioral Sciences Core Curriculum requirement)	3
FIN 3013	Principles of Business Finance	3
GBA 2013	Legal, Social and Ethical Issues in Business	3
IS 1403 or IS 1413	Business Information Systems Fluency Excel for Business Information Systems	3
IS 3003	Principles of Information Systems for Management	3
MAT 1053	Mathematics for Business (satisfies Mathematics Core Curriculum requirement; this course is not required for Actuarial Science majors) ¹	3
MAT 1133	Calculus for Business (satisfies Mathematics or Component Area Option Core Curriculum requirement; Actuarial Science majors must take MAT 1213 in lieu of MAT 1133)	3
MGT 3003	Business Communication and Professional Development	3

MGT 3013	Introduction to Organization Theory, Behavior, and Management	3
MGT 4893	Management Strategy (taken in semester of graduation)	3
MKT 3013	Principles of Marketing	3
MS 1023	Business Statistics with Computer Applications I (Actuarial Science majors must take STA 3003 in lieu of MS 1023)	3
MS 3043	Business Statistics with Computer Applications II (Actuarial Science majors must take STA 3513 in lieu of MS 3043)	3
MS 3053	Management Science and Operations Technology	3

Note: Students majoring in Actuarial Science, Economics, Finance, Operations and Supply Chain Management and Business Analytics are strongly encouraged to select IS 1413 Excel for Business Information Systems. IS 1413 is required for Accounting majors.

¹ Students may elect to substitute MAT 1093 Precalculus for MAT 1053 Mathematics for Business. Students electing to take MAT 1093 will need to meet prerequisites or achieve satisfactory performance on a placement examination. Visit UTSA Testing Services for more information regarding math placement exams.

In addition to the Core Curriculum requirements and requirements from the Carlos Alvarez College of Business Common Body of Knowledge (CBK), all candidates for the degree must complete the following degree requirements.

Gateway Course

Students pursuing the B.B.A. degree in Operations and Supply Chain Management must successfully complete the business math gateway course MAT 1053 (TCCN MATH 1323) or equivalent with a grade of "C-" or better in no more than two attempts. A student who is unable to successfully complete this course within two attempts, including dropping the course with a grade of "W" or by taking an equivalent course at another institution, will be required to change their major outside of business. **Upon the second failed attempt students will be changed to undeclared and will not be eligible for a Bachelor of Business Administration (B.B.A) or a Bachelor of Arts in Economics degree.**

Code	Title	Credit Hours
MAT 1053	Mathematics for Business	3

Degree Requirements (without track)

Code	Title	Credit Hours
A. Major Requirements 27		
MS 3403	Logistics Management	
MS 4333	Project Management	
MS 4343	Production/Operations Management	
MS 4543	Supply Chain Management	
Select five courses from the following:		
MS 3003	Visualization in Business Analytics	
MS 3063	Decision Support Systems	
MS 3073	Business Intelligence and Analytics	
MS 3313	Statistical Modeling for Business Analytics	

MS 3413	Purchasing and Inventory Management
MS 4313	Six Sigma and Lean Operations
MS 4323	Analytics with Spreadsheet and Simulation in Business
MS 4353	Service Operations Management
MS 4363	Quality Management and Control
MS 4383	Predictive Operational Analytics
MS 4913	Independent Study in Operations and Supply Chain Management
MS 4933	Internship in Operations and Supply Chain Management
MS 4953	Special Topics in Operations and Supply Chain Management

B. Support Work 51

Business Common Body of Knowledge (51 SCH) (9 SCH satisfy core curriculum requirements)

C. Free Electives 9

Select 9 semester credit hours of upper-division coursework

Option 1: Complete 9 semester credit hours of upper division business electives.

Option 2: Complete a business competency (9 semester credit hours in a competency).

Option 3: Complete 9 semester credit hours of free electives.

Total Credit Hours 87

Degree Requirements for Management Science Track

Code	Title	Credit Hours
A. Major Requirements 27		
MS 3403	Logistics Management	
MS 4333	Project Management	
MS 4343	Production/Operations Management	
Select six courses from the following: ¹		
FIN 4523	Introduction to Risk Management	
FIN 3063	Computer Modeling of Financial Applications	
MKT 3083	Marketing Research	
MS 3003	Visualization in Business Analytics	
MS 3063	Decision Support Systems	
MS 3073	Business Intelligence and Analytics	
MS 3083	Data Management for Business Analytics	
MS 3313	Statistical Modeling for Business Analytics	
MS 3413	Purchasing and Inventory Management	
MS 4203	Business Analytics Applications	
MS 4313	Six Sigma and Lean Operations	
MS 4323	Analytics with Spreadsheet and Simulation in Business	
MS 4353	Service Operations Management	
MS 4363	Quality Management and Control	
MS 4373	Data Mining for Business Analytics	
MS 4383	Predictive Operational Analytics	
MS 4543	Supply Chain Management	
MS 4913	Independent Study in Operations and Supply Chain Management	

MS 4933	Internship in Operations and Supply Chain Management	
MS 4953	Special Topics in Operations and Supply Chain Management	
STA 3003	Statistical Methods and Applications	
STA 3313	Statistical Sampling	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4233	Introduction to Programming and Data Management in R	
STA 4803	Statistical Quality Control	
B. Support Work		51
Business Common Body of Knowledge (51 SCH) (9 SCH satisfy core curriculum requirements)		
C. Free Electives		9
Select 9 semester credit hours of upper-division coursework.		
Option 1: Complete 9 semester credit hours of upper division business electives.		
Option 2: Complete a business competency (9 semester credit hours in a competency)		
Option 3: Complete 9 semester credit hours of free electives.		
Total Credit Hours		87

¹ To substitute another course for one of the above electives, a student should submit a petition to their academic advisor and receive approval from the chair of the Management Science and Statistics department or department designee before registering for the course.

Course Sequence Guide for B.B.A. Degree in Operations and Supply Chain Management

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

For options in designing and selecting career tracks and/or certificates, contact the chair of the Management Science and Statistics department or department designee.

Recommended Four-Year Academic Plan

First Year

		Credit Hours
Fall		
AIS 1233	AIS: Business (core)	3
MAT 1053	Mathematics for Business (core and CBK)	3
WRC 1013	Freshman Composition I (core)	3
American History (core)		3
Life & Physical Sciences (core)		3
Credit Hours		15
Spring		
MAT 1133	Calculus for Business (core and CBK) ¹	3

WRC 1023	Freshman Composition II (core)	3
ECO 2023	Introductory Microeconomics (core and CBK) ¹	3
ACC 2013	Principles of Accounting I (CBK)	3
IS 1403 or IS 1413	Business Information Systems Fluency (CBK) or Excel for Business Information Systems	3
Credit Hours		15

Second Year

Fall

MS 1023	Business Statistics with Computer Applications I (CBK)	3
MGT 3003	Business Communication and Professional Development	3
ECO 2013	Introductory Macroeconomics (CBK)	3
IS 3003	Principles of Information Systems for Management (CBK)	3
ACC 2033	Principles of Accounting II (CBK)	3
Credit Hours		15

Spring

MS 3043	Business Statistics with Computer Applications II (CBK)	3
MKT 3013	Principles of Marketing (CBK)	3
MGT 3013	Introduction to Organization Theory, Behavior, and Management (CBK)	3
FIN 3013	Principles of Business Finance (CBK)	3
American History (core)		3
Credit Hours		15

Third Year

Fall

MS 3053	Management Science and Operations Technology (CBK)	3
MS 4343	Production/Operations Management (major)	3
Upper-division Business elective (support work in major)		3
Upper-division Business elective (support work in major)		3
Creative Arts (core)		3
Credit Hours		15

Spring

MS 3403	Logistics Management (major)	3
MS 4313	Six Sigma and Lean Operations	3
Upper-division Business elective (support work in major)		3
Upper-division Business elective (support work in major)		3
Life & Physical Sciences (core)		3
Credit Hours		15

Fourth Year

Fall

Upper-division Business elective (support work in major)		3
GBA 2013	Legal, Social and Ethical Issues in Business (CBK)	3

Upper division Business elective, Business Competency course, or free elective (additional support work)	3
Language, Philosophy & Culture (core)	3
Government-Political Science (core)	3
Credit Hours	15
Spring	
Upper-division Business elective (support work in major)	3
MGT 4893 Management Strategy (CBK)	3
Upper-division Business elective, Business Competency course, or free elective (additional support work)	3
Upper-division Business elective, Business Competency course, or free elective (additional support work)	3
Government-Political Science (core)	3
Credit Hours	15
Total Credit Hours	120

¹ Carlos Alvarez College of Business students should take MAT 1053, MAT 1133, and ECO 2023 to satisfy both Core Curriculum and CBK requirements.

Bachelor of Science Degree in Statistics and Data Science

Statistics is a science that deals with principles and procedures for obtaining and processing information in order to make decisions in the face of uncertainty. In particular, it deals with collection, organization, analysis, and interpretation of numerical information to answer questions in almost every aspect of modern-day life. Statistical methods are used to address complex questions common in business, government, and science. Employers such as research divisions in pharmaceutical companies, clinical research units at medical centers, quality control or reliability departments in manufacturing companies, corporate planning and financial analysis units, and government agencies require persons with advanced quantitative skills.

The Bachelor of Science (B.S.) degree in Statistics and Data Science provides students with access to such skills preparing them for careers as statistical analysts or for further graduate academic training. The minimum number of semester credit hours required for the Bachelor of Science degree in Statistics and Data Science is 120, at least 39 of which must be at the upper-division level.

Core Curriculum Requirements (42 semester credit hours)

Students seeking the B.S. degree in Statistics and Data Science must fulfill University Core Curriculum requirements. The courses listed below satisfy both degree requirements and Core Curriculum requirements.

MAT 1213 should be used to satisfy the core requirement in Mathematics (020). ECO 2023 should be used to satisfy the core requirement in Social and Behavioral Sciences (080).

All degrees in the Carlos Alvarez College of Business require 120 hours. If students elect to take a course that satisfies both a Core and College requirement, students may need to take an additional course to meet the 120 hours.

Core Curriculum Component Area Requirements (<http://catalog.utsa.edu/undergraduate/bachelorsdegreeregulations/degreerequirements/corecurriculumcomponentarearequirements/>)

First Year Experience Requirement	3
Communication	6
Mathematics	3
Life and Physical Sciences	6
Language, Philosophy and Culture	3
Creative Arts	3
American History	6
Government-Political Science	6
Social and Behavioral Sciences	3
Component Area Option	3
Total Credit Hours	42

Degree Requirements

Code	Title	Credit Hours
A. Major Requirements		63
1. Required courses in the computational and mathematical sciences		
MAT 1213	Calculus I ¹	
MAT 1223	Calculus II	
MAT 2213	Calculus III	
MAT 2233	Linear Algebra	
2. Required statistics courses		
STA 3003	Statistical Methods and Applications	
STA 3013	Applied Multivariate Analysis	
STA 3513	Probability and Statistics	
STA 3523	Mathematical Statistics for Inference	
STA 4713	Applied Regression Analysis	
3. Computational and Statistical Software Courses: (Choose 2 out of 3)		
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4233	Introduction to Programming and Data Management in R	
STA 4243	Data Exploratory Methods with Python	
4. Select ten of the following		
CS 4013 or CS 4023	Fundamentals of Software Fundamentals of Systems	
STA 3313	Statistical Sampling	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4143	Data Mining and Predictive Modeling	
STA 4233	Introduction to Programming and Data Management in R	
STA 4243	Data Exploratory Methods with Python	
STA 4643	Introduction to Stochastic Processes	
STA 4723	Introduction to the Design of Experiments	
STA 4753	Time-Series Analysis	
STA 4803	Statistical Quality Control	
STA 4903	Applied Survival Analysis	
STA 4913	Independent Study in Statistics and Data Science	

STA 4933	Internship in Statistics and Data Science
STA 4953	Special Topics in Statistics and Data Science
STA 4963	Actuarial Science Examination Preparation

B. Support Work 18

18 semester credit hours of electives in disciplines where statistics is actively applied and practiced, of which at least nine (9) semester credit hours must be upper division. Students can use these credit hours to complete a minor or finish a specialization. Students are encouraged to discuss their interests in specializations with the academic advisor. Some examples (but not limited to these) of such specializations are shown below.

1. Specialization in Actuarial Science:

ACC 2013	Principles of Accounting I
ECO 2013	Introductory Macroeconomics
ECO 2023	Introductory Microeconomics
FIN 3013	Principles of Business Finance
FIN 3063	Computer Modeling of Financial Applications
STA 4963	Actuarial Science Examination Preparation

2. Specialization in Biology:

BIO 2313	Genetics
BIO 3283	Ecology
BIO 3323	Evolution
BIO 3333	Plants and Society
BIO 4033	Conservation Biology
NDRB 3433	Neurobiology

Total Credit Hours 81

¹ This course also fulfills the university's core course requirement.

Course Sequence Guide for B.S. Degree in Statistics and Data Science

This course sequence guide is designed to assist students in completing their UTSA undergraduate business degree requirements. This is a term-by-term sample course guide. Students must satisfy other requirements in their catalog and meet with their academic advisor for an individualized degree plan. Progress within this guide depends upon such factors as course availability, individual student academic preparation, student time management, work obligations, and individual financial considerations. Students may choose to take courses during Summer terms to reduce course loads during long semesters.

Recommended Four-Year Academic Plan

First Year

Fall		Credit Hours
MAT 1213	Calculus I (core and major)	3
AIS 1233	AIS: Business (core)	3
WRC 1013	Freshman Composition I (core)	3
American History (core)		3
Life & Physical Sciences (core)		3
Credit Hours		15

Spring

MAT 1223	Calculus II (major)	3
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STA 3003	Statistical Methods and Applications (major)	3
WRC 1023	Freshman Composition II (core)	3
American History (core)		3
Life & Physical Sciences (core)		3

Credit Hours 15

Second Year

Fall

MAT 2213	Calculus III (major)	3
STA 3513	Probability and Statistics (major)	3
Language, Philosophy & Culture (core)		3
Creative Arts (core)		3
Course option in computational and statistical software (major)		3

Credit Hours 15

Spring

MAT 2233	Linear Algebra (major)	3
STA 3523	Mathematical Statistics for Inference (major)	3
ECO 2023	Introductory Microeconomics (suggested core)	3

Government-Political Science (core) 3

Course option in computational and statistical software (major) 3

Credit Hours 15

Third Year

Fall

STA 3013	Applied Multivariate Analysis (major)	3
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Upper-division Statistics elective (major) 3

Upper-division Statistics elective (major) 3

Course option in specialization track (elective or support work) 3

Government-Political Science (core) 3

Credit Hours 15

Spring

Upper-division Statistics elective (major) 3

Upper-division Statistics elective (major) 3

Upper-division Statistics elective (major) 3

Course option in specialization track (elective or support work) 3

Component Area Option (core) 3

Credit Hours 15

Fourth Year

Fall

STA 4713 Applied Regression Analysis (major) 3

Upper-division Statistics elective (major) 3

Upper-division Statistics elective (major) 3

Course option in specialization track (elective or support work) 3

Course option in specialization track (elective or support work) 3

Credit Hours 15

Spring

Upper-division Statistics elective (major)	3
Upper-division Statistics elective (major)	3
Upper-division Statistics elective (major)	3
Course option in specialization track (elective or support work)	3
Course option in specialization track (elective or support work)	3
Credit Hours	15
Total Credit Hours	120

Accelerated Master of Science in Statistics and Data Science

The Department of Management Science and Statistics and Alvarez College of Business (ACOB) offer an Accelerated Statistics and Data Science Program tailored to UTSA students with exceptional motivation and qualifications. Designed to facilitate a seamless transition into a master's program and provide an expedited admission process, this program allows participants to initiate their graduate studies as early as the senior year of their undergraduate education.

The benefit of the accelerated program is it allows students to complete some graduate courses while still earning their undergraduate degree. In addition, students have the potential to reduce their time until graduation (e.g., students can start completing their graduate-level coursework during their senior year) and save money (e.g., students are not charged an application fee and potentially could double count one course), and creates an easier transition into graduate school (i.e., a known admission into graduate school while in their undergraduate education and a constant connection with the UTSA faculty and staff).

Program Admission Requirements

Applications to the Accelerated Program in Statistics and Data Science must meet the following criteria¹: 1) a current UTSA student, 2) completion of 90 semester credit hours in the semester of application, 3) a minimum grade point average of 3.0, and 4) earn a bachelor's degree in a relevant STEM or business domains. Applicants must apply online² for the Accelerated Statistics and Data Science Program and will be provided additional information upon submission.

This program is tailored to cater to the following individuals:

- UTSA students who aspire to pursue a bachelor's degree with a strong mathematical (e.g., complete Calculus III and Linear Algebra) background and a Master of Science (M.S.) in Statistics and Data Science. After appropriate consultation and approval from the program advisor, these students could replace some of the required M.S. courses with graduate electives. This would remove unnecessary course repetition and allow students to customize the program to serve their professional needs better.

Degree Requirements

Bachelor's Degree Requirement

Students accepted into the Accelerated Statistics and Data Science Program must complete all the degree requirements associated with their bachelor's degree.

M.S. Degree Requirement

Students accepted into the Accelerated Program in Statistics and Data Science are required to complete the standard degree requirement

of the M.S. in Statistics and Data Science as listed in the Graduate Catalog (<http://catalog.utsa.edu/graduate/business/managementsciencestatistics/#degreestext>).

Bachelor's/M.S. Classification

Upon acceptance into the Accelerated Statistics and Data Science Program, students are granted permission to enroll in graduate-level courses while still classified as undergraduates. Upon completing their bachelor's degree, students will receive a Keep Running with Us (KRWU) application to transition from undergraduate to graduate student status.

¹ These are the minimum criteria to be accepted into the Accelerated Program in Statistics and Data Science. After completing the online survey, a Statistics and Data Science faculty member will meet with each student to discuss their degree plan and the required expectations to be accepted into the program.

² Completing the survey is the first of two steps of the application process for the Accelerated Program in Statistics and Data Science. It connects students who are interested in the program with Statistics and Data Science faculty members, offers details about the program and the second step of the application process, fosters mentoring connections with Statistics and Data Science faculty members, and ultimately compiles a roster of students eligible for automatic admission into the M.S. in Statistics and Data Science program through KRWU.

- Minor in Actuarial Science (p. 11)
- Minor in Operations and Supply Chain Management (p. 12)
- Minor in Statistics (p. 12)

Minor in Actuarial Science

The Minor in Actuarial Science is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

Code	Title	Credit Hours
A. Required Business courses		6
ECO 2013	Introductory Macroeconomics	
ECO 2023	Introductory Microeconomics	
B. Select four of the following courses		12
STA 3513	Probability and Statistics	
STA 3523	Mathematical Statistics for Inference	
STA 4643	Introduction to Stochastic Processes	
STA 4713	Applied Regression Analysis	
STA 4753	Time-Series Analysis	
STA 4933	Internship in Statistics and Data Science	
Total Credit Hours		18

To declare a Minor in Actuarial Science, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor.

Minor in Operations and Supply Chain Management

The Minor in Operations and Supply Chain Management is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

Code	Title	Credit Hours
A. Required courses		6
MS 3053	Management Science and Operations Technology	
MS 4343	Production/Operations Management	
B. Select four of the following courses		12
ECO 3123	Introduction to Econometrics	
FIN 4523	Introduction to Risk Management	
FIN 3063	Computer Modeling of Financial Applications	
MKT 3083	Marketing Research	
MS 3063	Decision Support Systems	
MS 3073	Business Intelligence and Analytics	
MS 3313	Statistical Modeling for Business Analytics	
MS 3403	Logistics Management	
MS 3413	Purchasing and Inventory Management	
MS 4313	Six Sigma and Lean Operations	
MS 4323	Analytics with Spreadsheet and Simulation in Business	
MS 4333	Project Management	
MS 4353	Service Operations Management	
MS 4363	Quality Management and Control	
MS 4383	Predictive Operational Analytics	
MS 4543	Supply Chain Management	
MS 4913	Independent Study in Operations and Supply Chain Management	
MS 4933	Internship in Operations and Supply Chain Management	
MS 4953	Special Topics in Operations and Supply Chain Management	
STA 3003	Statistical Methods and Applications	
STA 3313	Statistical Sampling	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4753	Time-Series Analysis	
STA 4803	Statistical Quality Control	
Total Credit Hours		18

To declare a Minor in Operations and Supply Chain Management, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor.

Minor in Statistics

The Minor in Statistics is open to all majors in the University. All students pursuing the minor must complete 18 semester credit hours.

Code	Title	Credit Hours
A. Sequence options		6
Select two courses from the following:		
1. Option 1		
STA 1403	Probability and Statistics for the Biosciences	
STA 3003	Statistical Methods and Applications	
2. Option 2		
POL 2703	Scope and Methods	
PSY 2073	Statistics for Psychology	
3. Option 3		
MS 1023	Business Statistics with Computer Applications I	
MS 3043	Business Statistics with Computer Applications II	
4. Option 4		
STA 3003	Statistical Methods and Applications	
and one of the following:		
STA 2303	Applied Probability and Statistics for Engineers	
STA 3513	Probability and Statistics	
B. Select four of the following courses		12
MS 3073	Business Intelligence and Analytics	
STA 3013	Applied Multivariate Analysis	
STA 3313	Statistical Sampling	
STA 3523	Mathematical Statistics for Inference	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4143	Data Mining and Predictive Modeling	
STA 4233	Introduction to Programming and Data Management in R	
STA 4713	Applied Regression Analysis	
STA 4723	Introduction to the Design of Experiments	
STA 4753	Time-Series Analysis	
STA 4803	Statistical Quality Control	
or MS 4363	Quality Management and Control	
STA 4903	Applied Survival Analysis	
STA 4933	Internship in Statistics and Data Science	
STA 4953	Special Topics in Statistics and Data Science	
Total Credit Hours		18

To declare a Minor in Statistics, obtain advice, and seek approval of substitutions for course requirements, students must consult with their academic advisor or the designated statistics faculty member.

- Certificate in Business Analytics (p. 12)
- Certificate in Operations and Supply Chain Management (p. 13)

Certificate in Business Analytics

The Business Analytics certificate is designed to prepare business students with a foundational knowledge in analytics. It certifies to employers that students awarded the certificate have completed coursework that will help them understand different forms of analytics

(descriptive, predictive, and prescriptive) and the methods used in each. Moreover, this certificate program will help students learn cutting-edge techniques to sift through large volumes of data and understand how analytics can help improve decisions throughout an organization.

To earn a Business Analytics certificate, students must earn 15 semester credit hours as follows:

Code	Title	Credit Hours
A. Required courses		6
MS 3073	Business Intelligence and Analytics	
Choose one of the following three courses as the second required course: ¹		
MS 3083	Data Management for Business Analytics	
or STA 4133	Introduction to Programming and Data Management in SAS	
or STA 4233	Introduction to Programming and Data Management in R	
B. Elective Courses		9
MS 3003	Visualization in Business Analytics	
MS 3063	Decision Support Systems	
MS 3083	Data Management for Business Analytics	
MS 3313	Statistical Modeling for Business Analytics	
or STA 3013	Applied Multivariate Analysis	
MS 4203	Business Analytics Applications	
MS 4323	Analytics with Spreadsheet and Simulation in Business	
MS 4373	Data Mining for Business Analytics	
or STA 4143	Data Mining and Predictive Modeling	
STA 4133	Introduction to Programming and Data Management in SAS	
STA 4233	Introduction to Programming and Data Management in R	
Total Credit Hours		15

¹ *Note: STA 4133 and STA 4233 cannot count as an elective if MS 3083 is counted for the BA certificate.

To apply for the Business Analytics Certificate, students should consult with Department of Management Science and Statistics for specific information about certificate requirements and consult with their academic advisors to verify that they have met all university requirements as specified in chapter 2 (<http://catalog.utsa.edu/undergraduate/certificateprograms/>) of this catalog. All courses used to satisfy the requirements of this undergraduate certificate program must be college-level courses taken at UTSA.

Certificate in Operations and Supply Chain Management

This certificate is designed to prepare business students with a foundational knowledge in operations and supply chain management (OSCM). It certifies to employers that students awarded the certificate have completed coursework that will help them understand a myriad of issues, challenges, problems, and decision tools that relate to the internal and external flow of materials and requisite knowledge. Production/operations management, logistics management, and procurement

topics are included to resolve the myriad of complex problems facing organizations. Moreover, this certificate program will help students learn cutting edge techniques and best practices to leverage their operations and supply chain complexities to achieve competitive advantage.

To earn an Operations and Supply Chain Management Certificate (OSCM), students must earn 15 semester credit hours as follows:

Code	Title	Credit Hours
A. Required courses		6
MS 3403	Logistics Management	
MS 4543	Supply Chain Management	
B. Select one of the following		3
MS 3003	Visualization in Business Analytics	
MS 4343	Production/Operations Management	
MS 4353	Service Operations Management	
C. Select one of the following		3
MS 4313	Six Sigma and Lean Operations	
MS 4363	Quality Management and Control	
D. Select one of the following		3
MS 3413	Purchasing and Inventory Management	
MS 4333	Project Management	
MS 4383	Predictive Operational Analytics	
Total Credit Hours		15

To apply for the Operations and Supply Chain Management Certificate, students should consult with Department of Management Science and Statistics for specific information about certificate requirements and consult with their academic advisors to verify that they have met all university requirements as specified in chapter 2 (<http://catalog.utsa.edu/undergraduate/certificateprograms/>) of this catalog. All courses used to satisfy the requirements of this undergraduate certificate program must be college-level courses taken at UTSA.

Management Science (MS) Courses

MS 1023. Business Statistics with Computer Applications I. (3-0) 3 Credit Hours. (TCCN = BUSI 2305)

Prerequisites: A grade of "C-" or better in IS 1403 (or IS 1413) and MAT 1053, or equivalents. This is the first course in a sequence of three courses designed to introduce basic statistical and quantitative techniques for business and economics. This course examines analytical skills and statistical concepts important in business-oriented environments. Various statistical techniques will be presented to assist in solving problems encountered by organizations. Topics include, but are not limited to, descriptive statistics, measures of central tendency and dispersion, elementary probability theory, expected value, random variables, discrete and continuous distributions, sampling distributions, point and interval estimation, and hypothesis testing. Electronic spreadsheets will be utilized for analyzing and interpreting data. Generally offered: Fall, Spring, Summer. Course Fees: BISP \$10; BTSI \$15.41; DL01 \$75; LRB1 \$15.41.

MS 3003. Visualization in Business Analytics. (3-0) 3 Credit Hours.

This course covers the foundations of data visualization, exploratory data analysis, and data communication via interactive and non-interactive graphical analyses. Students will be able to articulate design principles and best practices for creating meaningful visual displays of data, prepare different types of data for visualization, develop and interpret a wide range of charts and graphs using software (e.g., Tableau), and effectively communicate data-driven business insights using visualizations. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 3043. Business Statistics with Computer Applications II. (3-0) 3 Credit Hours.

Prerequisites: A grade of "C-" or better in IS 1403 (or IS 1413), MAT 1053, and MS 1023, or equivalents. This course builds on the foundations learned in MS 1023. Statistical concepts include, but are not limited to, hypothesis testing concepts, goodness-of-fit tests, tests of independence, nonparametric tests, decision making under uncertainty, analysis of variance, correlation, linear and multiple regression, and time series. Electronic spreadsheets and statistical software will be utilized in analyzing and interpreting data and for hands-on assessment. Generally offered: Fall, Spring, Summer. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 3053. Management Science and Operations Technology. (3-0) 3 Credit Hours.

Prerequisites: A grade of "C-" or better in IS 1403 (or IS 1413), MAT 1053, and MS 1023 or equivalents. This is an introductory course in management science that emphasizes model building as a foundation for rational decision making and problem solving across disciplines and functional areas. Topics include, but are not limited to, mathematical programming, network models, project management, multi-criteria decision making, inventory management, service operations and queuing models, Markov analysis, and simulation. Computer software is used to apply these techniques in the analysis of a wide variety of decision problems. Generally offered: Fall, Spring, Summer. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 3063. Decision Support Systems. (3-0) 3 Credit Hours.

This course focuses on applications of decision-support models and computer software to problems in business, government, and other types of organizations with an emphasis on emerging technologies. It emphasizes fundamentals of decision support systems and hands-on experience using computer-based technologies to support organizational decision making. The primary focus is on four essential areas: decision analysis, simulation, project analysis, and mathematical programming. Excel, Microsoft Project, WINQSB, Expert Choice, and Extend are some of the software packages utilized. This course has Differential Tuition.

MS 3073. Business Intelligence and Analytics. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in MS 3043 or STA 3003 or the equivalent. This course is designed to provide an introduction to business analytics and offer context to introductory statistical models. It also describes and interprets the basic concepts of business analytics, including descriptive, predictive, and prescriptive analytics. Comparisons and contrasts among different business analytics techniques are examined. Students use computer software to conduct their analyses. Generally offered: Fall. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 3083. Data Management for Business Analytics. (3-0) 3 Credit Hours.

This course introduces essential programming concepts using R, SAS, and SQL to efficiently manipulate and clean data for statistical analyses. Topics include reading raw data, restructuring and combining data files, formatting and recoding variables, and displaying data using tables, charts, and plots. This course has Differential Tuition. Course fee: DL01 \$75.

MS 3313. Statistical Modeling for Business Analytics. (3-0) 3 Credit Hours.

Prerequisite: A grade of C- or better in MS 3073 and MS 3083, or approval of instructor. This course emphasizes application of statistics in problem-solving situations within business disciplines. Useful techniques include analysis of variance, multiple regression, logistic regression, discriminant analysis, factor analysis, principal component analysis, cluster analysis, multidimensional scaling, and conjoint analysis. Students use computer software (e.g., SPSS, SAS, and/or R) to conduct their analyses. (Formerly titled "Business Applications of Statistics.") Generally offered: Spring. This course has Differential Tuition.

MS 3403. Logistics Management. (3-0) 3 Credit Hours.

This course focuses on analyzing managerial decisions related to the movement and storage of supplies, work-in-process, and finished goods, examining the trade-offs encountered by managers: costs and service levels, level and modes of transportation used, warehousing and control of inventory levels, demand management and forecasting master production scheduling, just-in-time (JIT), materials requirements planning (MRP), MRP II, DRP, materials handling within warehouses, distribution of finished goods to customers, industrial packaging, and importance of logistics to the overall productivity of a firm are investigated. When available, an integrated software approach such as supply chain management (SCM) and enterprise resource planning (ERP) by SAP, Oracle or I2 will be adopted. Generally offered: Spring. This course has Differential Tuition. Course fee: DL01 \$75.

MS 3413. Purchasing and Supply Management. (3-0) 3 Credit Hours.

This course explores the strategic and tactical issues in procurement and supply management. Topics include, but are not limited to, purchasing process, procurement cycle, determination of requirements, supplier qualifications and relationships, appraisals, source selection, contract negotiation and management, commodity planning, buying practices, policies, ethics, and international purchasing. Cost, price, and value analysis in industrial purchasing cycle are also discussed. The course emphasizes a balance of academic and practitioner's perspectives. This course has Differential Tuition.

MS 4203. Business Analytics Applications. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in MS 4373 or the equivalent, or approval of instructor. This course presents an overview of business analytics applications, including its purpose, benefits and challenges, important analytic processes, and methodologies to perform business analytics in a data driven environment. Students will be introduced to a wide spectrum of relevant business analytics applications encountered in different functional areas. Scope of learning incorporates but not limited to hands-on experience, case-based study, and guest lectures from data analytics experts and managers. This course has Differential Tuition. Course fee: DL01 \$75.

MS 4213. Analytics for Healthcare Operations Management. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in STA 1053 and IS 1403 or their equivalents. This course provides students with the opportunity to apply analytics and operations management tools across a broad range of healthcare settings: critical, management, and support processes in the medical and public healthcare systems. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 4313. Six Sigma and Lean Operations. (3-0) 3 Credit Hours.

This course focuses on Six Sigma as a quality improvement methodology structured to reduce failure rates to a negligible level and on lean operations methodology structured to reduce waste. Materials include an overview of lean management philosophy and fundamentals of DMAIC problem-solving methodology. Topics include project criteria and prioritization methods, process capability measures, scorecard development, Six Sigma tools, DOE, and sampling and analyzing process data. Generally offered: Spring. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 4323. Analytics with Spreadsheet and Simulation in Business. (3-0) 3 Credit Hours.

A study of the techniques for modeling and analysis of business processes using computer simulation and animation is the focus of this course. Selected example applications from supply chain management, financial, marketing, and operations functions are included. The computer simulations provide support for the management decision process. This course has Differential Tuition.

MS 4333. Project Management. (3-0) 3 Credit Hours.

This course provides a practical examination of how projects are managed from start to finish. The emphasis is on planning and control to avoid common pitfalls and manage risk. Planning includes defining objectives, identifying activities, establishing precedence relationships, making time estimates, determining project completion times, and determining resource requirements. CPM/PERT networks are established, and computer software (Microsoft Project, WINQSB, and Excel) is used to monitor and control the project. Generally offered: Fall. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 4343. Production/Operations Management. (3-0) 3 Credit Hours.

This course focuses on the production and operations management function in business. It includes a review of the methods required for design, operation, and improvements of the systems that create products or services. Traditional topics in manufacturing and service operations are investigated including an introduction to supply chain management concepts. Generally offered: Fall. This course has Differential Tuition. Course Fee: DL01 \$75.

MS 4353. Service Operations Management. (3-0) 3 Credit Hours.

This course is designed to provide an in-depth examination of operations management practices in service-oriented environments. The subjects introduced include topics from operations management, logistics, marketing, economics, and management demonstrated in a broad spectrum of service organizations. The course looks at strategic concepts in modern service management and presents analytical tools for business decision making. Topics include, but are not limited to, service quality, process design, facility location analysis and site selection, waiting line models, inventory management in services, demand forecasting, workforce scheduling, learning curve models, overbooking, service supply chain, and integrated service operations management. (Same as MKT 4353. Credit cannot be earned for both MS 4353 and MKT 4353.) Generally offered: Fall. This course has Differential Tuition.

MS 4363. Quality Management and Control. (3-0) 3 Credit Hours.

This course investigates the fundamental nature of quality and its implications for business. Topics include statistical methods for quality improvement in manufacturing and service operations. Emphasis is given to both the technical and managerial issues in understanding and implementing quality as a component for success in today's global business environment. (Same as STA 4803. Credit cannot be earned for both MS 4363 and STA 4803.) This course has Differential Tuition. Course Fee: BISP \$10; BTSI \$15.41; LRB1 \$15.41.

MS 4373. Data Mining for Business Analytics. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in MS 3073 and MS 3083, or approval of instructor. This course provides an introduction to machine learning algorithms with applications. Topics include supervised and unsupervised learning methods, resampling methods, model selection, generalized additive model, classification and regression tree methods, k-nearest neighbors, bagging and random forest, support vector machines, social network analysis, and text mining. (Formerly titled "Knowledge Discovery for Business Analytics.") This course has Differential Tuition. Course Fee: DL01 \$75.

MS 4383. Predictive Operational Analytics. (3-0) 3 Credit Hours.

This course introduces modern and practical methods for operations planning and decision making. Short-term forecasting of demand, personnel requirements, costs and revenues, raw material needs, and desired inventory levels are some of the topics included. Other topics covered include technological and environmental forecasting, decomposition methods, time series, and monitoring (automatic procedures such as tracking signals). (Formerly titled Applied Forecasting in Operations.) This course has Differential Tuition.

MS 4543. Supply Chain Management. (3-0) 3 Credit Hours.

Principles, techniques and practices of corporate supply chain management are covered in this course. The focus is on the strategic coordination and information management that integrates supplier selection, purchasing, transportation, inventory and warehousing, channel planning and configuration, production and distribution from procurement of raw material to customer satisfaction. Business decision models and techniques for facility location, production, inventory, transportation and other operational issues are presented. Currently available software will be surveyed and cases of successful implementations will be analyzed. Generally offered: Spring. This course has Differential Tuition.

MS 4913. Independent Study in Operations and Supply Chain Management. (0-0) 3 Credit Hours.

Prerequisites: For business majors: A 3.0 Carlos Alvarez College of Business grade point average, permission in writing from the instructor, the Department Chair, and the Dean of the Carlos Alvarez College of Business (see academic advisor for required forms and additional requirements). Independent reading, research, discussion, and/or writing under the direction of a faculty member. This course may be repeated for credit, but not more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

MS 4923. Independent Study in Business Analytics. (0-0) 3 Credit Hours.

Prerequisite: For business majors: A 3.0 Carlos Alvarez College of Business grade point average, permission in writing from the instructor, the Department Chair, and the Dean of the Carlos Alvarez College of Business (see academic advisor for required forms and additional requirements). Independent reading, research, discussion, and/or writing under the direction of a faculty member. This course may be repeated for credit, but no more than 6 semester credit hours of independent study, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

MS 4933. Internship in Operations and Supply Chain Management. (0-0) 3 Credit Hours.

Prerequisites: A 2.5 grade UTSA point average and approval in writing from the instructor, the Department Chair, and the Associate/Assistant Dean of Undergraduate Studies in the Carlos Alvarez College of Business (see academic advisor for required forms and additional requirements). Supervised full- or part-time work experience in management science. Offers opportunities for applying management science in private businesses or public agencies. A written report is required. May be repeated for credit, but not more than 6 semester credit hours will apply to a bachelor's degree. Generally offered: Summer. This course has Differential Tuition.

MS 4943. Internship in Business Analytics. (0-0) 3 Credit Hours.

Prerequisite: A 2.5 UTSA grade point average and approval in writing from the instructor, the Department Chair, and the Associate/Assistant Dean of Undergraduate Studies in the Carlos Alvarez College of Business (see academic advisor for required forms and additional requirements). Supervised full- or part-time work experience in business analytics. Offers opportunities for applying business analytics in private businesses or public agencies. A written report is required. May be repeated for credit, but no more than 6 semester credit hours will apply to a bachelor's degree. Generally offered: Summer. This course has Differential Tuition.

MS 4953. Special Topics in Operations and Supply Chain Management. (3-0) 3 Credit Hours.

Prerequisite: Consent of instructor, Department Chair, and Dean. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special studies may be repeated for credit when the topics vary. This course has Differential Tuition.

MS 4963. Special Topics in Business Analytics. (0-0) 3 Credit Hours.

Prerequisite: MS 3073 and MS 3083 or equivalents. This course explores current and relative topics related to business analytics not covered elsewhere in the Business Analytics program. Special Topics may be repeated for credit when the topics vary, but not more than six semester credit hours will apply towards the support course requirements. This course has Differential Tuition.

Statistics (STA) Courses

STA 1053. Basic Statistics. (3-0) 3 Credit Hours. (TCCN = MATH 1342)

Prerequisite: Satisfactory performance on placement examination. Descriptive statistics; histograms; measures of location and dispersion; elementary probability theory; random variables; discrete and continuous distributions; interval estimation and hypothesis testing; simple linear regression and correlation; one-way analysis of variance, and applications of the chi-square distribution. May be applied toward the core curriculum requirement in Mathematics. Generally offered: Fall, Spring, Summer. Course Fees: BISP \$10; BTSI \$15.41; DL01 \$75; LRB1 \$15.41; LRC1 \$12.

STA 1403. Probability and Statistics for the Biosciences. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in MAT 1193 or an equivalent. Probability and statistics from a dynamical perspective, using discrete-time dynamical systems and differential equations to model fundamental stochastic processes such as Markov chains and the Poisson processes important in biomedical applications. Specific topics to be covered include probability theory, conditional probability, Markov chains, Poisson processes, random variables, descriptive statistics, covariance and correlations, the binomial distribution, parameter estimation, hypothesis testing and regression. (Formerly STA 1404. Credit cannot be earned for both STA 1403 and STA 1404.) Generally offered: Fall, Spring, Summer. Course Fees: BISP \$10; BTSI \$15.41; LRB1 \$15.41; DL01 \$75.

STA 2303. Applied Probability and Statistics for Engineers. (3-0) 3 Credit Hours.

Prerequisite: MAT 1223. Fundamental concepts of probability and statistics with practical applications to engineering problems. Emphasis on statistical distribution models used in reliability and risk analysis of engineering design; probabilistic reasoning; Bayes' theorem; bivariate and multivariate distributions and their applications. Generally offered: Fall, Spring. Course Fee: BISP \$10; BTSI \$15.41; LRB1 \$15.41; DL01 \$75.

STA 3003. Statistical Methods and Applications. (3-0) 3 Credit Hours.

Prerequisite: Completion of MAT 1093 (or equivalent). Introduction to the Scientific Method, principles of sampling and experimentation, scales of measurement, summary statistics, introduction to basic probability, models for discrete and continuous data, simple simulations, fundamentals of hypothesis testing and confidence intervals, and introduction to analysis of variance and linear regression model. The course will emphasize data analysis and interpretation, and effective communication of results through reports or presentations. Generally offered: Fall, Spring, Summer. This course has Differential Tuition. Course Fee: DL01 \$75.

STA 3013. Applied Multivariate Analysis. (3-0) 3 Credit Hours.

Prerequisite: MAT 2233, STA 3003, or equivalents. This course emphasizes application of statistics in organizations. Topics include but are not limited to multivariate normal distribution, tests on means, discriminant analysis, cluster analysis, principal components, and factor analysis. Use of software packages will be emphasized. Open to students of all disciplines. Generally offered: Spring. This course has Differential Tuition.

STA 3023. Mathematics for Statistics. (3-0) 3 Credit Hours.

Prerequisite: MAT 1223 or an equivalent. This course discusses and reviews the classic mathematical methods and techniques to comprehend the advanced statistical concepts. Concepts include sequences, series, convergence, limit, continuity, derivative, optimization, the fundamental theorem of calculus, methods of integration, Taylor expansions, function of several variables, partial derivatives, and multivariate transformations. Other topics include vector and matrix algebra, determinants, inverse matrix, solving linear equations, orthogonality (projections, least-squares, Gram-Schmidt), eigenvalues and eigenvectors (diagonalization, symmetric/positive definite matrices), and singular value decomposition. (Formerly titled Statistical Mathematics.) This course has Differential Tuition.

STA 3313. Statistical Sampling. (3-0) 3 Credit Hours.

Prerequisite: One of the following: MS 1023, STA 1053, STA 2303, STA 3003, or an equivalent. Research techniques for collecting quantitative data: sample surveys, designed experiments, simulations, and observational studies; development of survey and experimental protocols; measuring and controlling sources of measurement error. Generally offered: Fall. This course has Differential Tuition. Course Fee: DL01 \$75.

STA 3333. Introduction to Data Science and Analytics. (3-0) 3 Credit Hours.

Prerequisite: One of the following: MS 1023, STA 1053, STA 1403, STA 2303, or an equivalent. Data science and analytics aim to harness the power of data and statistics for new insights. This course introduces the concepts and principles of data science and analytics through software-aided applications of common statistics-based methods, tools and techniques in various practical case studies. This course also provides students an opportunity to understand the data-driven decision making process, an overview of the data science lifecycle, and the Big Data ecosystem. Topics include popular statistical techniques and algorithms under the current paradigm of analytics (descriptive/diagnostic, predictive/prognostic, and prescriptive/optimization) and machine learning (supervised and unsupervised), applied in a wide variety of fields as demonstrated through case studies. With the application-oriented focus, students will gain hands-on experiences and develop essential skills in discovering, analyzing, visualizing, interpreting data, presenting and communicating results. This course has Differential Tuition.

STA 3513. Probability and Statistics. (3-0) 3 Credit Hours.

Prerequisite: STA 3003, MAT 1223 or STA 3023, and completion of or concurrent enrollment in MAT 2213. Axiomatic probability, random variables, discrete and continuous distributions, bivariate and multivariate distributions and their applications, mixture distributions, moments and generating functions, and bivariate transformations. Generally offered: Fall, Spring, Summer. This course has Differential Tuition. Course Fee: DL01 \$75.

STA 3523. Mathematical Statistics for Inference. (3-0) 3 Credit Hours.

Prerequisite: STA 3513 or an equivalent. Sampling distributions and the Central Limit Theorem; order statistics; estimation including method of moments and maximum likelihood; properties of estimators; hypothesis testing including likelihood ratio tests; introduction to ANOVA and regression. Generally offered: Fall, Spring. This course has Differential Tuition. Course fee: DL01 \$75.

STA 4133. Introduction to Programming and Data Management in SAS. (3-0) 3 Credit Hours.

This course introduces essential programming concepts using the statistical software package SAS (Enterprise Guide and Base SAS) with a focus on data management and the preparation of data for statistical analyses. Topics include reading raw data, creating temporary and permanent datasets, manipulating datasets, data prompts, summarizing data, displaying data using tables, charts, and plots. Conducting basic statistical analyses using the SAS Enterprise Guide and the Base SAS procedures are also discussed with the examples selected from regression analysis, analysis of variance, and categorical analysis. This course also demonstrates how to write, generate, and modify SAS code and procedures within the SAS Enterprise Guide and the Base SAS environments. This course has Differential Tuition. Course fee: DL01 \$75.

STA 4143. Data Mining and Predictive Modeling. (3-0) 3 Credit Hours.

Prerequisite: STA 4133 or equivalent. Acquisition, organization, exploration, and interpretation of large data collections. Data cleaning, representation and dimensionality, multivariate visualization, clustering, classification, and association rule development. A variety of commercial and research software packages will be used. This course has Differential Tuition. Course fee: DL01 \$75.

STA 4233. Introduction to Programming and Data Management in R. (3-0) 3 Credit Hours.

This course introduces statistical computing and programming using the R language. Topics include preprocessing/manipulating datasets, summarizing/visualizing data, and conducting basic statistical analyses using R. Other topics include writing R functions, object oriented programming, statistical simulation and resampling, interfacing R with other programming language environments such as SQL, Python, C++, and Hadoop. Techniques for efficient programming will be stressed. The concept of high-performance computing (multi-core/parallel-processing) is also demonstrated. (Formerly titled Statistical Applications Using SAS Software.) Generally offered: Spring. This course has Differential Tuition. Course fee: DL01 \$75.

STA 4243. Data Exploratory Methods with Python. (3-0) 3 Credit Hours.

This course provides an overview of Exploratory Data Analysis (EDA), including the cleaning, preparation, exploration, and visualization of data. Students will learn how to source, manage, transform, and explore a wide variety of data types. Students will also master the fundamental concepts for visualizing and communicating information contained in raw data. Python software is used for the course. Prior knowledge of a programming language and basic statistics is beneficial but is not required. This course has Differential Tuition.

STA 4643. Introduction to Stochastic Processes. (3-0) 3 Credit Hours.

Prerequisite: MAT 2233 and STA 3513 (or equivalents). Probability models, Poisson processes, finite Markov chains, including transition probabilities, classification of states, limit theorems, queuing theory, and birth and death processes. Generally offered: Summer. This course has Differential Tuition. Course Fees: BISP \$10; BTSI \$15.41; LRB1 \$15.41.

STA 4713. Applied Regression Analysis. (3-0) 3 Credit Hours.

Prerequisite: Completion of or concurrent enrollment in STA 3523, or consent from instructor. An introduction to regression analysis, with emphasis on practical aspects, fitting a straight line, examination of residuals, matrix treatment of regression analysis, fitting and evaluation of general linear models, and nonlinear regression. Generally offered: Fall. This course has Differential Tuition.

STA 4723. Introduction to the Design of Experiments. (3-0) 3 Credit Hours.

Prerequisite: STA 3513, or equivalents. General concepts in the design and analysis of experiments. Emphasis will be placed on both the experimental designs and analysis, and tests of the validity of assumptions. Topics covered include completely randomized designs, randomized block designs, complete factorials, fractional factorials, and covariance analysis. The use of computer software packages will be stressed. This course has Differential Tuition. Course Fee: DL01 \$75.

STA 4753. Time-Series Analysis. (3-0) 3 Credit Hours.

Prerequisite: STA 3003 and STA 3513, or equivalents. Development of descriptive and predictive models for time-series phenomena. A variety of modeling approaches will be discussed: decomposition, moving averages, time-series regression, ARIMA, and forecasting errors and confidence intervals. Generally offered: Spring. This course has Differential Tuition.

STA 4803. Statistical Quality Control. (3-0) 3 Credit Hours.

Prerequisite: STA 3003, STA 3513, (or equivalents). Statistical methods are introduced in terms of problems that arise in manufacturing and their applications to the control of manufacturing processes. Topics include control charts and acceptance sampling plans. (Same as MS 4363 and MAT 4803. Credit cannot be earned for more than one of the following: STA 4803, MS 4363, or MAT 4803.) This course has Differential Tuition.

STA 4903. Applied Survival Analysis. (3-0) 3 Credit Hours.

Prerequisite: STA 3513 or an equivalent. Measures of survival, hazard function, mean residual life function, common failure distributions, procedures for selecting an appropriate model, the proportional hazards model. Emphasis on application and data analysis using SAS. This course has Differential Tuition.

STA 4911. Independent Study. (0-0) 1 Credit Hour.

Prerequisite: A 3.0 Carlos Alvarez College of Business grade point average, permission in writing (form available) from the instructor, the student's advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition. Course Fee: BISP \$10; BTSI \$15.41.

STA 4913. Independent Study in Statistics and Data Science. (0-0) 3 Credit Hours.

Prerequisites: A 3.0 Carlos Alvarez College of Business grade point average, permission in writing (form available) from the instructor, the student's advisor, the Department Chair, and the Dean of the College in which the course is offered. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

STA 4933. Internship in Statistics and Data Science. (0-0) 3 Credit Hours.

Prerequisites: A 2.5 grade UTSA point average, and approval in writing from the instructor, the Department Chair, and the Associate/Assistant Dean of Undergraduate Studies in the Carlos Alvarez College of Business (see academic advisor for required forms and additional requirements). Supervised full- or part-time work experience in statistics. Offers opportunities for applying statistics in private businesses or public agencies. A written report is required. May be repeated for credit, but not more than 6 semester credit hours will apply to a bachelor's degree. This course has Differential Tuition.

STA 4953. Special Topics in Statistics and Data Science. (3-0) 3 Credit Hours.

Prerequisite: Consent from the instructor, Department Chair, and Dean of the College. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Topics may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

STA 4961. Actuarial Science Examination Preparation. (1-0) 1 Credit Hour.

An organized course offering specialized study for Actuarial Science Examinations. Topics covered include General Probability, Random Variables and Probability Distributions, Multivariate Distributions, and Risk Management and Insurance. May be repeated twice for credit. Generally offered: Fall, Spring. This course has Differential Tuition. Course Fee: BISP \$10; BTSI \$15.41; LRB1 \$15.41.

STA 4963. Actuarial Science Examination Preparation. (3-0) 3 Credit Hours.

Prerequisite: STA 3513. An organized course offering specialized study for Actuarial Science Examination. Topics covered include General Probability, Random Variables and Probability Distributions, Multivariate Distributions, and Stochastic Processes. This course has Differential Tuition. Course Fee: DL01 \$75.

STA 4993. Honors Thesis. (0-0) 3 Credit Hours.

Prerequisites: STA 3523 and consent from instructor, Department Chair and Dean of the College; enrollment limited to students applying for Honors in Management Science and Statistics. Supervised research and preparation of an honors thesis. May be repeated once for credit with advisor's approval. Generally offered: Spring. This course has Differential Tuition.