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CSCI 509-01W Introduction to Computational Science

COURSE SYLLABUS: Spring 2020

INSTRUCTOR INFORMATION

Instructor:	**Kwang Lee, Ph.D.**
Office Location:	Online, must login eCollege
Office Hours:	**Mon, Wed, 09:00am ~ 12:00pm**
Office Phone:	**571-275-0959**
Office Fax:	**None**
University Email Address:	**Kwang.Lee@tamu.edu**
Preferred Form of Communication:	**For all Email contacts make sure - THE Email Subject Is: "CSCI509~~"**
Communication Response Time:	**Email or Online Discuss**

COURSE INFORMATION

MANDATORY TEXTBOOKS:

- Langtangen, H.P. (2012). A Primer on Scientific Programming with Python 3rd ed. Springer.
- Newman, M. (2012). Computational Physics. CreateSpace

RECOMMENDED TEXTBOOKS:

- Introduction to Computation and Programming Using Python, 2nd Edition by John V. Guttag, The MIT Press: ISBN: 978-0262529624
- Intro to Python for Computer Science and Data Science: Learning to Program with AI, Big Data and The Cloud by Paul J. Deitel, Deitel & Associates, Inc., 2020: ISBN: 978-0135404676

Course Description

Big scientific data sets are growing exponentially both in size and complexity. Extracting meaningful information from this data requires not only programming skills, but also understanding the analysis work-flows and mathematical models and visualization tools

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that help to condense large amounts of information into a comprehensible story. Computational science is the scientific investigation of problems through modeling, simulation and analysis of physical processes on a computer. Computational science is now considered by most scientists to be on par with the development of scientific theory and the use of experimentation in order to understand more about our world. Computational science is not the same as computer science. Rather, it is an interdisciplinary blend of scientific models, applied mathematics, computational techniques, and practices. This Introduction to Computational Science course focuses upon simple and intuitive computational models and methods.

Student Learning Outcomes

1. Be able to apply numerical solutions to scientific modeling problems.
2. Apply computational techniques to tackling scientific research questions.
3. Familiarize with standard tools of computational science: HPC, R/Python/Numpy/Scipy toolkit stack, markup and documentation systems, plotting and visualization, etc.
4. Understand stochastic models and be able to apply to building simple Monte Carlo simulations.
5. Be familiar with fundamental building blocks of numerical modeling and discrete calculus for computational approximation.
6. Understand importance of series and difference equations for discrete approximations of numerical methods.
7. Learning outcomes will be measured through mapping assignment and test questions to specific outcome items, as well as through exit surveys of student experiences with the outcome familiarity.

COURSE REQUIREMENTS

This course forms one of the core subjects in the master's degree program in the Computational Sciences. Computational sciences differs from the traditional computer science discipline in several ways, but most importantly as being focused on applying computational methods to solving large scientific problems. Thus this type of scientific data analysis of large complex data sets is both increasingly crucial to scientific research, as well as being in great demand for practitioners who can apply computational analysis and modeling to such data sets. This course directly addresses this area, and forms a cornerstone subject for any student wishing to understand and practice computational science research.

Goals include:

- Understand the scientific process and the philosophy of science.
- Understand the purpose and value of computational science.
- Be exposed to the common tools and practices of working

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computational scientists.
- Learn to use basic computational simulation and modeling tools, specifically the Python toolkit stack.
- Be exposed to basic data analysis and modeling concepts and practices.
- Learn about common computational algorithms for performing scientific modeling, including computational integration and differentation, random Monte Carlo methods, solutions of ordinary differential equations, etc.

Minimal Technical Skills Needed

Students should be proficient in a high level programming language, like C++, Python or Java.

Instructional Methods

All materials, assignments and tests will be conducted through the D2L MyLeo Online learning system.

Student Responsibilities or Tips for Success in the Course

To plan a minimum of three hours of outside preparation for each hour of class is a safe time allocation for successfully completing the course.

Examination:

- **Midterm/Final exam will be worth 400 points and will be 40 percent of your course grade**. Similar to the midterm exam. The exams consist of essay questions prepared by your instructor. You will have 7 days, unlimited access to complete both parts of your final exam.

Written Assignments and Term Project:

- The objective of graduate level writing assignments and project is to promote attitudes and skills that will improve a student's ability to communicate in writing, develop research skills and documentation techniques, and encourage critical analysis of data and conclusions. So the written essay assignments and the term project will be assigned to you. Students must complete the assignment totaling a minimum of ten pages of writing.
- **Each written paper will be worth 100 point and a project will be worth 150 point (for total of 450 points), and will be 45 percent of your course grade.** You justify ideas and response by using appropriate examples and references from texts, Web sites, other references, or personal experience and cited the sources in the correct APA format.

- **APA Style**
  TAMUC uses the APA (American Psychological Association) Writing Style in all its courses which require a Paper or Essay. Instructors provide information on some useful resources in the course.
  http://www.apastyle.org/

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Assignments and project will be posted in university's eCollege communication system. Detailed information will be provided by the instructor. Students also should turn in their assignments through eCollege portal. Each student is responsible for the content/instructions of email communications.

All assignments and project must be completed and submitted into **"Dropbox"** on due date. Work must be **complete**. I will not accept a partially completed assignment. Your work **must** be your **own.** Cheating will result in a grade of 0 for the applicable assignment; further disciplinary action, including assigning a failing grade (F) for the entire course may also be taken. Missed work will result in a grade of 0 for the assignment. Exceptional circumstances should be discussed with the instructor in advance.
Assignments must be printed out (when appropriate) and **properly identified**. Each must include:

- Your **Name**
- The **Assignment** and/or **File Name**

Threaded Discussions:

- **Threaded discussions worth 150 points and will be 15 percent of your course grade**. Must post your responses to our discussion questions by the due date. Discussion questions are posted under each week's Assignment tab as well as discussion board tab. You need to post your responses under discussion board. Your participation in our weekly discussion is valuable for the duration of the thread. Please post your responses by the due date/s for each week. Responses posted after the due date **WILL NOT** be graded and zero points will be issued for that week's discussion. I will not extend the due date for participation in our weekly discussion/s.

GRADING

Your grade for the course will be based on the following percentages (tentative):

• Exam	400 (40%)
• Assignments	300 (30%)
• Term Project	150 (15%)
• Discussions	150 (15% -- each 25 points)
Total	1,000 (100%)

You should do your own work on exams/projects and for computer assignments. Copying another student's work is not acceptable. Any indication of cheating and/or plagiarism on an exam/assignment/project will be an automatic 0 (zero) for the exam/assignment/project for all students involved. Yet, based on cheating and plagiarism activity in any section of class, instructor holds the right to give F grade to the identified student(s). Regarding codes in assignments / projects, you may be required to explain

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the code you submitted. In case of discursive explanation, the instructor holds the right to lower your grade.

Letter grades will be assigned according to the following scale:

- A - at least 900 (90%) of the total points
- B - at least 800 (80%) of the total points
- C - at least 700 (70%) of the total points
- F - less than 700 (70%) of the total points

TECHNOLOGY REQUIREMENTS

Browser support

D2L is committed to performing key application testing when new browser versions are released. New and updated functionality is also tested against the latest version of supported browsers. However, due to the frequency of some browser releases, D2L cannot guarantee that each browser version will perform as expected. If you encounter any issues with any of the browser versions listed in the tables below, contact D2L Support, who will determine the best course of action for resolution. Reported issues are prioritized by supported browsers and then maintenance browsers.

Supported browsers are the latest or most recent browser versions that are tested against new versions of D2L products. Customers can report problems and receive support for issues. For an optimal experience, D2L recommends using supported browsers with D2L products.

Maintenance browsers are older browser versions that are not tested extensively against new versions of D2L products. Customers can still report problems and receive support for critical issues; however, D2L does not guarantee all issues will be addressed. A maintenance browser becomes officially unsupported after one year.

Note the following:

- Ensure that your browser has JavaScript and Cookies enabled.
- For desktop systems, you must have Adobe Flash Player 10.1 or greater.
- The Brightspace Support features are now optimized for production environments when using the Google Chrome browser, Apple Safari browser, Microsoft Edge browser, Microsoft Internet Explorer browser, and Mozilla Firefox browsers.

Desktop Support

Browser	Supported Browser Version(s)	Maintenance Browser Version(s)
Microsoft® Edge	Latest	N/A

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Browser	Supported Browser Version(s)	Maintenance Browser Version(s)
Microsoft® Internet Explorer®	N/A	11
Mozilla® Firefox®	Latest, ESR	N/A
Google® Chrome™	Latest	N/A
Apple® Safari®	Latest	N/A

Tablet and Mobile Support

Device	Operating System	Browser	Supported Browser Version(s)
Android™	Android 4.4+	Chrome	Latest
Apple	iOS®	Safari, Chrome	The current major version of iOS (the latest minor or **point** release of that major version) and the previous major version of iOS (the latest minor or **point** release of that major version). For example, as of June 7, 2017, D2Lsupports iOS 10.3.2 and iOS 9.3.5, but not iOS 10.2.1, 9.0.2, or any other version. Chrome: Latest version for the iOS browser.
Windows	Windows 10	Edge, Chrome, Firefox	Latest of all browsers, and Firefox ESR.

- You will need regular access to a computer with a broadband Internet connection. The minimum computer requirements are:
    - 512 MB of RAM, 1 GB or more preferred
    - Broadband connection required courses are heavily video intensive

The *syllabus/schedule are subject to change.*

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  - Video display capable of high-color 16-bit display 1024 x 768 or higher resolution

- You must have a:
  - Sound card, which is usually integrated into your desktop or laptop computer
  - Speakers or headphones.
  - *For courses utilizing video-conferencing tools and/or an online proctoring solution, a webcam and microphone are required.

- Both versions of Java (32 bit and 64 bit) must be installed and up to date on your machine. At a minimum Java 7, update 51, is required to support the learning management system. The most current version of Java can be downloaded at: JAVA web site http://www.java.com/en/download/manual.jsp

- Current anti-virus software must be installed and kept up to date.

Running the browser check will ensure your internet browser is supported.

Pop-ups are allowed.
JavaScript is enabled.
Cookies are enabled.

- You will need some additional free software (plug-ins) for enhanced web browsing. Ensure that you download the free versions of the following software:
  - Adobe Reader https://get.adobe.com/reader/
  - Adobe Flash Player *(version 17 or later)* https://get.adobe.com/flashplayer/
  - Adobe Shockwave Player https://get.adobe.com/shockwave/
  - Apple Quick Time http://www.apple.com/quicktime/download/

- At a minimum, you must have Microsoft Office 2013, 2010, 2007 or Open Office. Microsoft Office is the standard office productivity software utilized by faculty, students, and staff. Microsoft Word is the standard word processing software, Microsoft Excel is the standard spreadsheet software, and Microsoft PowerPoint is the standard presentation software. Copying and pasting, along with attaching/uploading documents for assignment submission, will also be required. If you do not have Microsoft Office, you can check with the bookstore to see if they have any student copies.

ACCESS AND NAVIGATION

You will need your campus-wide ID (CWID) and password to log into the course. If you do not know your CWID or have forgotten your password, contact the Center for IT Excellence (CITE) at 903.468.6000 or helpdesk@tamuc.edu**.**

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Note: Personal computer and internet connection problems do not excuse the requirement to complete all course work in a timely and satisfactory manner. Each student needs to have a backup method to deal with these inevitable problems. These methods might include the availability of a backup PC at home or work, the temporary use of a computer at a friend's home, the local library, office service companies, Starbucks, a TAMUC campus open computer lab, etc.

COMMUNICATION AND SUPPORT

Brightspace Support

Need Help?

Student Support

If you have any questions or are having difficulties with the course material, please contact your Instructor.

Technical Support

If you are having technical difficulty with any part of Brightspace, please contact Brightspace Technical Support at 1-877-325-7778 or click on the **Live Chat** or click on the words "click here" to submit an issue via email.

System Maintenance

D2L runs monthly updates during the last week of the month, usually on Wednesday. The system should remain up during this time unless otherwise specified in an announcement. You may experience minimal impacts to performance and/or look and feel of the environment.

Interaction with Instructor Statement

The instructor's communication response time and feedback on assessments are stated clearly.

COURSE AND UNIVERSITY PROCEDURES/POLICIES

Course Specific Procedures/Policies

ASSIGNMENT AND LATE POLICY

The objective of written assignments is to promote attitudes and skills that will improve a student's ability to communicate in writing, develop research skills and documentation techniques, and encourage critical analysis of data and conclusions.

The *syllabus/schedule are subject to change.*

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All assignments and project must be written in MS-word.doc format and uploaded into each assignment content holder on due date. Click each assignment tile on eCollege, then go to the assignment materials screen and then attach the local assignment from your computer using "Brows My Computer."

You justify ideas and response by using appropriate examples and references from texts, Web sites, other references, or personal experience and cited the sources in the correct APA format.

American Psychological Association (APA) Style

All written work submitted by students in this course must confirm to the most recent APA guidelines for referencing, in text citations, appendices, and/or any means of crediting an outside source.

Work must be **complete**. I will not accept a partially completed assignment. Your work **must** be your **own.** Cheating will result in a grade of 0 for the applicable assignment; further disciplinary action, including assigning a failing grade (F) for the entire course may also be taken. Missed work will result in a grade of 0 for the assignment. Exceptional circumstances should be discussed with the instructor in advance.

Assignments and project must be printed out (when appropriate) and **properly identified**. Each must include:

- Your **Name**
- Your **Student ID**
- The **Assignment** and/or **File Name**

Late Assignment and Project Policy:

Credit will be given for ONLY those exams, programs, and/or projects turned in no later than the deadline as announced by the instructor of this class, unless prior arrangement has been made with the instructor.

Late programs / projects / assignments can gain partial credit upon the following policy. As per University requirements, assignments submitted within 7 days after the deadline can receive up to 20% deduction, assignments submitted between 8-14 days after the deadline can receive up to 50% deduction.

- **No assignments and project will be accepted two weeks after the assigned due date**
- **Final assignment will not be accepted after the term end day**
- Exceptions to this policy will only be made in extraordinary circumstances. Please let me know your circumstances.

Late Discussion Policy:

I decided not to accept any late discussion. The discussion has a different purpose from the written assignment. As you know, the main purpose of discussion is to exchange idea and opinions with other colleagues. If you are late to participate in the discussion, you

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cannot archive this purpose via the discussion. I would not keep track of when the late discussions were turned in.

Syllabus Change Policy

The syllabus is a guide. Circumstances and events, such as student progress, may make it necessary for the instructor to modify the syllabus during the semester. Any changes made to the syllabus will be announced in advance.

University Specific Procedures

Student Conduct

All students enrolled at the University shall follow the tenets of common decency and acceptable behavior conducive to a positive learning environment. The Code of Student Conduct is described in detail in the Student Guidebook.
http://www.tamuc.edu/Admissions/oneStopShop/undergraduateAdmissions/studentGuidebook.aspx

Students should also consult the Rules of Netiquette for more information regarding how to interact with students in an online forum: Netiquette
http://www.albion.com/netiquette/corerules.html

TAMUC Attendance

For more information about the attendance policy please visit the Attendance webpage and Procedure 13.99.99.R0.01.
http://www.tamuc.edu/admissions/registrar/generalInformation/attendance.aspx

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/academic/13.99.99.R0.01.pdf

Academic Integrity

Students at Texas A&M University-Commerce are expected to maintain high standards of integrity and honesty in all of their scholastic work. For more details and the definition of academic dishonesty see the following procedures:

Undergraduate Academic Dishonesty 13.99.99.R0.03

http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/undergraduates/13.99.99.R0.03UndergraduateAcademicDishonesty.pdf

Graduate Student Academic Dishonesty 13.99.99.R0.10

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http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/13students/graduate/13.99.99.R0.10GraduateStudentAcademicDishonesty.pdf

ADA Statement

Students with Disabilities

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you have a disability requiring an accommodation, please contact:

Office of Student Disability Resources and Services

Texas A&M University-Commerce
Gee Library- Room 162
Phone (903) 886-5150 or (903) 886-5835
Fax (903) 468-8148
Email: studentdisabilityservices@tamuc.edu

Website: Office of Student Disability Resources and Services

http://www.tamuc.edu/campusLife/campusServices/studentDisabilityResourcesAndServices/

Nondiscrimination Notice

Texas A&M University-Commerce will comply in the classroom, and in online courses, with all federal and state laws prohibiting discrimination and related retaliation on the basis of race, color, religion, sex, national origin, disability, age, genetic information or veteran status. Further, an environment free from discrimination on the basis of sexual orientation, gender identity, or gender expression will be maintained.

Campus Concealed Carry Statement

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations.

For a list of locations, please refer to the Carrying Concealed Handguns On Campus document and/or consult your event organizer.

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Web url: http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf

Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1.

COURSE OUTLINE / CALENDAR

DATE	Assignments	INFORMATION
Week 01 01/13	Introduction	Introduction to Python **Introduction and Greeting: Listed under week 1 tab** **Due: No later than 11:59 pm Sun**
Week 02 01/20		Introduction to NumPy Scientific library **Discussion 1: Listed under week 2 tab** **Due: No later than 11:59 pm Sun**
Week 03 01/27		Speedy and Accuracy **Discussion 2: Listed under week 3 tab** **Due: No later than 11:59 pm Sun**
Week 04 02/03	Assignment 1	Sequences and Difference Equations **Written Assignment 1: Listed under week 4 tab (Due: 7 Days of Week 4)** **Due: No later than 11:59 pm Sun**
Week 05 02/10		Taylor Series
Week 06 02/17		Integral and Differential Calculus **Discussion 3: Listed under week 6 tab** **Due: No later than 11:59 pm Sun**
Week 07 02/24	Assignment 2	Numerical Integration **Written Assignment 2: Listed under week 8 tab (Due: 7 Days of Week 7)** **Due: No later than 11:59 pm Sun**
Week 08 03/02	Exam	Integration and Differentiation **Midterm Exam** **Due: No later than 11:59 pm Sun**
Week 09 03/09		**Spring Break (No Class)**
Week 10 03/16		Linear Algebra and Solutions of ODE **Discussion 4: Listed under week 10 tab** **Due: No later than 11:59 pm Sun**
Week 11		Systems of Equation

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03/23		**Discussion 5: Listed under week 11 tab** **Due: No later than 11:59 pm Sun**
Week 12 03/30	Assignment 3	Nonlinear Equations **Written Assignment 3: Listed under week 14 tab (Due: 7 Days of Week 12)** **Due: No later than 11:59 pm Sun**
Week 13 04/06		Introduction to Probability and Statistics
Week 14 04/13		Randomness and Statistics **Discussion 6: Listed under week 14 tab** **Due: No later than 11:59 pm Sun**
Week 15 04/20	Term Project	Monte Carlo Simulation **Term Project (Due: 7 Days of Week 15)** **Due: No later than 11:59 pm Sun**
Week 16 04/27	Exam (Wrap-up)	**Final Examination** The exam will be due No later than 11:59 pm Sun

Academic Integrity Policy
The Department is committed to maintaining the integrity and respectability of degrees conferred and course credit earned through our department. Academic dishonesty restricts the understanding of subject material by the perpetrator, distracts and discourages other class members, and reduces the value of the economic signal of degrees conferred through Texas A&M University - Commerce. Whether courses are online, face-to-face, or hybrid combinations; the faculty, staff, and student members of the Department are committed to protecting the integrity of our courses, regardless of the delivery method.

Sufficient Notice
This policy, along with other University guidelines, represents sufficient notice to any student enrolled in a department course or program that his/her conduct in that course or program is governed by these academic integrity standards. Ignorance of this policy is neither an excuse nor a mitigating circumstance for violations.

Conduct Covered
No bulleted list of approved or disallowed behavior can substitute for our student body's commitment to act in ways that are consistent with moral principles, values, and a guiding sense of personal integrity. As faculty, we are committed to providing quality education both online and in the classroom. Likewise, academic ethics apply regardless of the delivery method of the

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course. However, in the interest of being specific, the following behaviors are generally not allowed and constitute academic dishonesty:

- Plagiarism - Defined by the Oxford English Dictionary as, "1. The action or practice of plagiarizing; the wrongful publication or purloining, and publication as one's own of the ideas, or expression of the ideas (literary, artistic, musical, mechanical, etc.) of another."

- Cheating on course assignments and assessments - Any attempt to circumvent the integrity of the grading system constitutes cheating. This includes use of resources that are not allowed (e.g. notes, calculators, books), assistance from other people (e.g. friends, parents, classmates, spouses). Your grade should reflect what you know – if it does not, you may have cheated. If you have questions about whether or not an action or resource is allowable, contact your instructor BEFORE you engage in the behavior.

- Collusion – any agreement or understanding to work as a group, unless specifically allowed by the instructor, is a form of cheating. Providing assistance to others by allowing them to copy work, or answering questions collaboratively when not allowed to do so is cheating. All individuals involved are guilty of collusion.

- Abuse – Any improper use, misuse or perversion of University facilities, resource material, or intellectual property. This could include theft of electronic documents (e.g. through copying, photographing or hacking), sale of material, or intimidation of fellow students, faculty or staff – either physical or electronically.

This list is not comprehensive, but provides examples of unethical behavior. If you have questions about what is allowable, contact your instructor with enough time to allow them to respond.

Disciplinary Action

Disciplinary action for academic misconduct is under the purview of the instructor. However, discipline can include any combination of the following:

1. Point deduction on an assignment.
2. Failure for an assignment.
3. A grade of zero for an assignment.
4. Failure for the course.
5. Referral to the Academic Integrity Committee or department head for further action.
6. Referral to the Dean of the College of Business.

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7. Referral to the University Discipline Committee – this may lead to expulsion from the University.

Campus Concealed Carry

Texas Senate Bill - 11 (Government Code 411.2031, et al.) authorizes the carrying of a concealed handgun in Texas A&M University-Commerce buildings only by persons who have been issued and are in possession of a Texas License to Carry a Handgun. Qualified law enforcement officers or those who are otherwise authorized to carry a concealed handgun in the State of Texas are also permitted to do so. Pursuant to Penal Code (PC) 46.035 and A&M-Commerce Rule 34.06.02.R1, license holders may not carry a concealed handgun in restricted locations. For a list of locations, please refer to

((http://www.tamuc.edu/aboutUs/policiesProceduresStandardsStatements/rulesProcedures/34SafetyOfEmployeesAndStudents/34.06.02.R1.pdf) and/or consult your event organizer). Pursuant to PC 46.035, the open carrying of handguns is prohibited on all A&M-Commerce campuses. Report violations to the University Police Department at 903-886-5868 or 9-1-1