1. Course Information:
Course : EMSE 4765.DO1/EMSE 6765.DO1 – Data Analysis for Scientists and Engineers
Semester : Summer 2020  # of Credit Hours: 3.0
Meeting Time : Thursday from 3:30PM to 6:00PM
Location : Online, Tompkins Hall Computer Lab 405 available remotely.

2. Instructor and Contact Information:
Name : J. René van Dorp, Professor
Campus Address : 800 22nd Street, Office 2800, Washington DC 20052
Phone : 202-994-6638
E-mail : dorpjr@gmail.com
Office hours : Tuesdays 2:00PM to 3:00PM

3. Course Description:
Inference methods in a single dimension: estimation, confidence intervals, hypothesis testing and goodness-of-fit testing; multivariate data analysis techniques using matrices and vectors: the Hotelling T-squared test, multiple linear regression, one way ANOVA, two-way ANOVA and 2^K ANOVA.

4. Prerequisite Requirement:
APSC 3115: Engineering Analysis III (or any other undergraduate Applied Statistics course from a physical or natural sciences program).
http://www.seas.gwu.edu/~dorpjr/APSC3115/Intro.html

5. Required Materials:
a. No Textbook Required.
b. Electronic Lectures notes available at:
   http://www2.seas.gwu.edu/~dorpjr/EMSE4765/Coursefiles.html
c. MS Excel Software
d. MINITAB software (available on lab computers)’ Six months or twelve months rental of the MINITAB Software is available for students at a discounted rate at:
   http://www.onthehub.com/minitab/

6. Recommended Materials:
a. Recommended Text Books (two available for download on Spring Link):
   • "Analyzing Multivariate Data” by Lattin, Carroll and Green.
b. Recommended Software: R and R Studio: Students will be introduced to the open source R statistical software environment.

7. Learning Outcomes
As a result of completing this course, students will be able to:
   a. Perform univariate statistical inference techniques involving confidence intervals, hypothesis test, distribution fitting and goodness-of-fit testing. Students will learn to perform these inference techniques in MS EXCEL.
   b. Perform multivariate statistical inference techniques involving estimation of the sample mean vector, the sample variance covariance matrix and use these to perform the Hotelling T^2 hypothesis test on a single multivariate sample and two multivariate samples. Students will learn to perform these inference techniques in MS EXCEL.
   c. Perform regression analysis involving multiple explanatory variables using matrix algebra in MS EXCEL. Student will learn to perform and interpret regression analysis results using the software MINITAB
   d. Perform One-Way and Two-Way ANOVA using the software MINITAB.

8. Attendance
Regular class attendance is strongly encouraged. You will be held responsible for all the class discussions as well as the reading assignments. Here is the university policy: https://registrar.gwu.edu/university-policies#attendance

9. Independent Learning
In a 14-week semester, including exam week, students are expected to spend a minimum of 100 minutes of out-of-class work for every 50 minutes of direct instruction, for a minimum total of 2.5 hours a week. A 3-credit course should include 2.5 hours of direct instruction and a minimum of 5.5 hours of independent learning or a total minimum of 8.0 hours per week. More information about GW’s credit hour policy can be found at: https://provost.gwu.edu/policies-procedures-and-guidelines and click on Assignments of Credit Hour Policy (PDF), Or see the PDF pages (webpage); https://provost.gwu.edu/files/downloads/Resources/Assignment-of-Credit-Hours_Final_Oct-2016.pdf

10. Method of Instruction:
One hour and 20 minutes lecture including homework discussion, followed by a 10 minute break and a one hour lecture. Microsoft Excel and Minitab are used to perform statistical analysis during the class sessions and the homework. During class sessions the only software programs that should be open on your desktop are either Adobe Acrobat (for viewing the notes) or Microsoft Excel or MINITAB for statistical analysis. **Reading assignments will have to be completed before class. Homework will have to be completed and handed-in accordance to the outline schedule one class after it was assigned and before the class starts.** During the class sessions (except for the break of
11. Homework Grading Policy:
Homework sets consisting of multiple homework problems will have to be completed prior to the next class for discussion and uploaded through Blackboard. A student may be called upon to discuss their solution for each homework problem in a homework set, so you must be prepared! The rest of the class should be involved in the discussion. Your level of effort will be graded. Not handing in a solution for a homework problem will result in 0 points. Homework problems that are handed in on time AND demonstrate an adequate level of effort will typically be awarded 1 point. Partial points can be awarded for homework problems in a homework set. At times a larger homework problem may be awarded a number of effort points larger than 1, which will be indicated. Homework sets that are handed in one day late receive a maximum of 50% of the assigned homework credit. Homework sets that are handed in more than one day late will not be awarded any credit.

12. Midterm Exam and Final Reports:
Students will complete an in-class Midterm Exam using Microsoft Excel + MINITAB (using a lab computer or the student’s laptop). Theoretical questions will be answered in an exam booklet. The MS EXCEL file, the MINITAB file and the exam booklet will be part of the grading of the midterm exam. One multivariate dataset will be provided to the students for analysis. Students will be required to perform the multivariate data analysis using that dataset and write a final report detailing their analysis steps, final analysis results and analysis conclusions. Students are required to submit the electronic files associated with the final report through blackboard as well as a electronic pdf file of the final report that will be graded. Students are required to work on their own to perform the multivariate analysis using that multivariate data sets and write the final report on their own.

13. Grading:
30% - Homework
30% - Midterm Exam (In-Class)
40% - Multivariate Data Analysis + Final Report

14. Homework Set and Reading Assignments:
Homework sets, Lecture notes and recommended chapters for reading will be assigned prior to class as indicated in the outline below.
<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Day of Week</th>
<th>Reading Assignments</th>
<th>Topics</th>
<th>Homework Assigned</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>21-May</td>
<td>Thursday</td>
<td>Ch. 1, 2, 3</td>
<td>Why Prob. And Stats?, Probability Calculus Review</td>
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<tr>
<td>2</td>
<td>28-May</td>
<td>Thursday</td>
<td>Ch. 4, 5</td>
<td>Discr. and Cont. Distributions Review</td>
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<td>2</td>
<td>28-May</td>
<td>Thursday</td>
<td>Ch. 7, 10</td>
<td>Expectation, Variance and Covariance Review</td>
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<tr>
<td>2</td>
<td>28-May</td>
<td>Thursday</td>
<td>Ch. 15, 16</td>
<td>Exploratory data analysis: Graphical + Numerical Summaries Review</td>
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<tr>
<td>3</td>
<td>4-Jun</td>
<td>Thursday</td>
<td>Ch. 17</td>
<td>Basic Statistical Models Review</td>
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<tr>
<td>3</td>
<td>4-Jun</td>
<td>Thursday</td>
<td>Ch. 23</td>
<td>Confidence intervals for the mean: Essentials Review</td>
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<td>4</td>
<td>11-Jun</td>
<td>Thursday</td>
<td>LN S4</td>
<td>Estimator distributions, Confidence Intervals for mean and Variance</td>
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<td>5</td>
<td>18-Jun</td>
<td>Thursday</td>
<td>LN S5</td>
<td>Goodness-of-Fit, Method-of-Moments, Maximum Likelihood</td>
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<tr>
<td>5</td>
<td>18-Jun</td>
<td>Thursday</td>
<td>LN S5</td>
<td>Credibility Intervals, Two Sample Hypothesis Testing</td>
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<td>6</td>
<td>25-Jun</td>
<td>Thursday</td>
<td>LN S6</td>
<td>Joint Normal Distribution, Vectors and Matrices, Matrix Algebra, Linear Combinations</td>
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<tr>
<td>6</td>
<td>25-Jun</td>
<td>Thursday</td>
<td>Ch. 2</td>
<td>Coordinate Systems, Geometric Interpretation, Joint Normal Distribution, Multivariate Point Estimation</td>
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<td>7</td>
<td>2-Jul</td>
<td>Thursday</td>
<td>LN S7</td>
<td>Single Sample Hotelling's T^2 Test</td>
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<tr>
<td>7</td>
<td>2-Jul</td>
<td>Thursday</td>
<td>Two Sample Multivariate Hotelling's T^2 Test</td>
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<tr>
<td>8</td>
<td>9-Jul</td>
<td>Thursday</td>
<td></td>
<td>Discuss Solution Practice Exam, Homework Set 7</td>
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<tr>
<td>9</td>
<td>16-Jul</td>
<td>Thursday</td>
<td>MIDTERM EXAM - PART 1, PART 2 and PART 3</td>
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<tr>
<td>10</td>
<td>23-Jul</td>
<td>Thursday</td>
<td>LN S9, Ch. 3</td>
<td>Simple Linear Regression, Model Testing, Parameter Inference</td>
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<tr>
<td>11</td>
<td>30-Jul</td>
<td>Thursday</td>
<td>LN S11, Ch. 3</td>
<td>Multiple Regression, Residual Diagnostics</td>
<td>REGRESSION DATA SET AVAILABLE</td>
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<td>12</td>
<td>6-Aug</td>
<td>Thursday</td>
<td>LN S12, Ch. 3</td>
<td>Outlier Detection, Comparing Imbedded Models</td>
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<td>12</td>
<td>6-Aug</td>
<td>Thursday</td>
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<td>Forecasting</td>
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<td>13</td>
<td>13-Aug</td>
<td>Thursday</td>
<td>LN S13</td>
<td>One-Way Analysis of Variance (ANOVA)</td>
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<td>14</td>
<td>20-Aug</td>
<td>Thursday</td>
<td>LN S14</td>
<td>Two-Way ANOVA, 2K ANOVA</td>
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<tr>
<td>14</td>
<td>20-Aug</td>
<td>Thursday</td>
<td></td>
<td>FINAL REPORT PART 4 DUE ON AUGUST 20th, 2020</td>
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</table>
15. **Academic integrity:**

Academic integrity is central to the learning and teaching process. Students are expected to conduct themselves in a manner that will contribute to the maintenance of academic integrity by making all reasonable efforts to prevent the occurrence of academic dishonesty. Academic dishonesty includes, but is not limited to, obtaining or giving aid on an examination, having unauthorized prior knowledge of an examination, doing work for another student, and plagiarism of all types. Ignorance is no excuse.

The number one problem that students run into with regards to academic integrity is plagiarism. It is not okay to copy, use, or otherwise exploit other people’s ideas, words, or creations without giving them credit in the proper form. Sometimes this means you must use quotation marks; while other times a simple source citation will do the trick. Changing a few words in a paraphrase is not enough to turn source material into “your own words” – in fact, that’s a really bad idea to even try. Changing the phrasing order of sentences is not okay and using the thesaurus to find ways to change “happy” to “glad” is also a very bad idea. It is expected that students know how to correctly quote and cite material, and also how to write well. For those students who need assistance, the GWU Writing Center is available. Please see: [https://writingcenter.gwu.edu/](https://writingcenter.gwu.edu/)

**Academic Integrity Code:**

Academic dishonesty is defined as cheating of any kind, including misrepresenting one’s own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For the remainder of the code, see: [https://studentconduct.gwu.edu/code-academic-integrity](https://studentconduct.gwu.edu/code-academic-integrity)

16. **What to do if the instructor does not arrive:**

If the Instructor does not arrive for the class at the designated starting time and has not notified the class of a late starting time or the cancellation of the class, the students should wait in the classroom for at least 30 minutes before departing. One member of the class should be selected to notify the EMSE Department of the Instructor’s absence by calling the EMSE Department 202-994-4892 on next business day.

17. **University Policy on Religious Holidays:**

In accordance with University Policy,

a. Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance.

b. Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations.

c. Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course-related activities. For more details and policy and accommodations for religious holidays please see: [https://students.gwu.edu/accommodations-religious-holidays](https://students.gwu.edu/accommodations-religious-holidays)
18. Support for Students Outside the Classroom:

Disability Support Services (DSS):
Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: https://disabilitysupport.gwu.edu/

Mental Health Services:
Colonial Health Services: 202-994-5300 (24Hours/7Days).
The University’s Mental Health Service offers 24/7 assistance and referral to address students’ personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations, confidential assessment, counseling services (individual and small group), and referrals: https://healthcenter.gwu.edu/mental-health

19. Security and Safety Policy:
GW Campus Advisories; Students should check the GW Campus Advisories Web Site at: https://campusadvisories.gwu.edu/ for current information related to campus conditions, closures, safety information and any other information concerning events that may disrupt normal operations. Life-Threatening Emergencies On Campus: Call GWPD at 202-994-6111

GW Alert Notifications:
GW Campus Advisories. Students should check the GW Campus Advisories Web Site at: http://www.campusadvisories.gwu.edu/index.cfm for current information related to campus conditions, closures, safety information and any other information concerning events that may disrupt normal operations. All students, faculty and staff registered in the GW banner system GW will receive emergency alerts, notifications and updates sent directly to their GW email address. If individuals elect to receive these alerts on a mobile device they may logon to GWeb Information Web Site at: https://banweb.gwu.edu/ and update their contact information to include mobile devices.