

**ITP489**  
**In-Memory DBMS for Real Time Analytics**

**Instructor:** Richard W. Vawter  
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**ITP 489**, Spring 2023  
**Location:** SOS B44  
T/Th 12:00-1:50 p.m.

**Office:** Rapp Engineering Bldg (RRB), Suite #241

**Zoom Office:** <https://usc.zoom.us/j/92533897852>

**Office Hours:** M/W 10:30 - 11:50 am  
1:00 - 1:50 pm (*except on 1<sup>st</sup> Wed. of each month*)  
T/Th 11:00 - 11:50 am

**Class Web Page:** <https://blackboard.usc.edu/>

**Teaching Assistant:** TBD

**Course Description:**

Multi-core processors and the availability of large amounts of main memory at low costs have made in-memory database management possible, enabling enterprises to collect and analyze vast amounts of data in real time. This course is designed to provide the student with a thorough understanding of the architecture and capabilities of in-memory database applications. Case studies on how businesses in various industries use data analytics for strategic decision making will be discussed and assignments will enable students to analyze large data sets to support their own strategic decisions.

**Objectives:**

At the completion of the course, students will be able to...

- Explain how various industries can use analytics to make strategic decisions
- Describe the architecture of in-memory database management systems
- Model and prepare an in-memory system for data population
- Identify which analytic models are most appropriate for a particular data set
- Analyze given data sets using tools such as SAP Predictive Analysis and SAS
- Make strategic business decisions based upon analytic results

**Suggested Textbooks:**

- In-Memory Data Management, 2<sup>nd</sup> edition, by Hasso Plattner and Alexander Zeier, Springer, ©2012, ISBN: 978-3-642-29574-4
- SAP Hana Essentials, by Jeffrey Word, , ebook version:  
<https://www.amazon.com/SAP-HANA-Essentials-Jeffrey-Word-ebook/dp/B0089N7BHK>

**Suggested References:**

- SAP HANA Academy:  
<http://www.saphana.com/community/implement/hana-academy>
- SAS Statistics 1: Introduction to ANOVA, Regression, and Logistic Regression  
<https://support.sas.com/edu/schedules.html?ctry=us&crs=STAT1>

## Computer Software

- The software which you will be using throughout the semester is located on Viterbi's Virtual Desktop system. By enrolling in the ITP course, you automatically have access to this system.
- Instructions on how to log in to the Virtual Desktop system will be posted on the course Blackboard web page, within the "Course Information" module.

## Lab Assignments:

- At the beginning of each week, Assignments will be available within the "Weekly Content" section of the class Blackboard web site.
- You are to turn in only the "Answer sheet" and "Summary" portion of the project write-up as one document.
- It is **your** responsibility to turn in the lab assignments by the deadlines indicated later in this syllabus **and** verify that your assignment is available in the class "assignment box".
  - If you can't see or open your document, then neither can the grader!
- Answers to the assignments will be posted on the class web page immediately after the due date of the assignments for your review.

## Case Studies

- Three case studies will be assigned during the semester.
- You are to read over the cases and type up a one-page analysis, double-spaced, explanation of the business situation, concerns, and possible suggested actions to take.
- Case studies are to be submitted by the beginning of the lecture on the dates indicated on the syllabus within the "Weekly Content" section of the class website (just as you do for submitting your Assignments).

## Late Assignments and Case Write-ups

- The Assignments link within the class web site "closes" after the due date and time.
  - You will no longer be able to submit your assignment and your assignment will be considered late!



- **No late assignments will be accepted for credit. No excuses!** So, please turn in your assignments at the beginning of lecture on the dates indicated in this syllabus and noted on the class web site !

## Handling Assignment Questions (in order of steps to be taken)

1. Re-read the instructions carefully.
2. Review the "Discussion Board" section of the class web site's forum for other students' questions and solutions or post a question yourself to begin the forum.
3. And, of course, you are always welcome and encouraged to "stop by" during my office hours, or the TA's, to discuss your questions.

## Final Project:

- The final project will require that the student take all that he/she has learned during the semester through the readings, case studies, and assignments, and apply it to a real-world situation. At minimum, the student will import data into an in-memory database system, model that data appropriately, and perform routine analytics. The student's recommendations presented in the conclusion of the final project must be supported by their analysis of the data.



- **No late final projects will be accepted for credit.**

**Examinations:** Exams cover material from the reading assignments, lectures, and assignments.

There will be two parts to the exam: ① a written exam containing questions of the form: multiple choice, short answer, and short problem solving, and ② a practical “lab” portion in which you will conduct exercises similar to those in the assignments. The exams will include material presented up to the date of the exam. The “Final” exam will be comprehensive and cover material presented throughout the semester, though emphasis will be placed upon the latter part of the course.

|               |              |                 |         |
|---------------|--------------|-----------------|---------|
| • Exam 1:     | Tues. Feb. 6 | 12:00-1:50 p.m. | SOS B44 |
| • Exam 2:     | Tues. Mar. 7 | 12:00-1:50 p.m. | SOS B44 |
| • Final Exam: | Wed. May 10  | 2:00-4:00 p.m.  | SOS B44 |

**! Note: Exams will be conducted in class during the times indicated above. No make-up exams will be offered nor will there be any changes made to the Final Exam schedule as established by the University.**

### **Grading:**

Grading will be on a straight scale (as opposed to a class curve/average).

|                               |    |
|-------------------------------|----|
| 94% and above                 | A  |
| 90% - 94% (not including 94%) | A- |
| 87% - 90% (not including 90%) | B+ |
| 83% - 87% (not including 87%) | B  |
| 80% - 83% (not including 83%) | B- |
| 77% - 80% (not including 80%) | C+ |
| etc.                          |    |

Grades will be calculated by weighing the following work as described here:

|                                  |            |
|----------------------------------|------------|
| Average of Lab Assignment scores | 25%        |
| Exam #1                          | 10%        |
| Exam #2                          | 15%        |
| SAS Analysis Game                | 5%         |
| Case write-ups                   | 10%        |
| Final Project                    | 15%        |
| Final Exam                       | <u>20%</u> |
|                                  | 100%       |

**! Final grades will be based strictly upon the total percentage earned. No exceptions! Nor, will any extra credit assignments be offered.**

Assignments, lectures, grades, discussion and all other course materials will be posted on <https://blackboard.usc.edu> . Please check the class website regularly.

**Class Schedule:**

| <b>Class</b>                         | <b>Topic</b>   | <b>Suggested Reading</b>                                  | <b>Assignment</b>   |
|--------------------------------------|--|---|---|
| <b>Week 1.</b><br>Jan. 10<br>Jan. 12 | <b>Course Overview</b> <ul style="list-style-type: none"> <li>• Discuss the Syllabus</li> <li>• Overview of In-Memory Database Systems</li> </ul>  | Plattner: Introduction & Ch.1<br>Word: Ch. 1              | <b>Case #1</b> – Carolina's Health Care System, due next Tuesday before class.  |
| <b>Week 2.</b><br>Jan. 17<br>Jan. 19 | <b>Relational Databases</b> <ul style="list-style-type: none"> <li>• Discuss the Carolina's Health Care System case</li> <li>• Overview of Relational DB databases &amp; Normalization</li> </ul>            | Class notes   | <b>Assignment #1</b> – Overview of RDBMS, due next Tuesday before class.  |
| <b>Week 3.</b><br>Jan. 24<br>Jan. 26 | <b>HANA, In-Memory DBMS</b> <ul style="list-style-type: none"> <li>• Wrap up Normalization</li> <li>• Intro to In-Memory Database Mgmt Systems &amp; the HANA In-Memory Computing Engine</li> </ul>          | Plattner: Ch.4.1 – Ch.4.4<br>Berg: Ch. 5.6<br>Word: Ch. 2 | <b>Assignment #2</b> – Overview of In-Memory DBMS, due next Tuesday before class.<br><b>Case #2</b> – Basecamp Pricing, due next Thursday before class. |
| <b>Week 4.</b><br>Jan. 31<br>Feb. 2  | <b>Reporting &amp; Analysis</b> <ul style="list-style-type: none"> <li>• Using the HANA Studio for initial data presentation and Excel for Analysis</li> <li>• Discuss the Basecamp Pricing case.</li> </ul> | Berg: Ch.6  | <b>Assignment #3</b> – Intro to Reporting, due next <b>Monday</b> , before 5:00 pm.   |
| <b>Week 5.</b><br>Feb. 7<br>Feb. 9   | <b>Data Provisioning</b> <ul style="list-style-type: none"> <li>• <b>Exam #1</b></li> <li>• Importing and preparing data for reporting and analysis</li> </ul>   | Berg: Ch.10<br>Word: Ch. 6                                | <b>Assignment #4</b> – Data Provisioning, due next Tuesday before class.  |
| <b>Week 6.</b><br>Feb. 14<br>Feb. 16 | <b>Data Modeling</b> <ul style="list-style-type: none"> <li>• Data Structures &amp; the Modeling Process</li> <li>• Attribute &amp; Analytic Views</li> </ul>  | Berg: Ch.8<br>Word: Ch.7                                  | <b>Assignment #5</b> –Data Modeling I, due next Tuesday before class.   |
| <b>Week 7.</b><br>Feb. 21<br>Feb. 23 | <b>Data Modeling (continued)</b> <ul style="list-style-type: none"> <li>• Incorporating calculations columns in modeling views</li> <li>• Using Variables and Decision Tables</li> </ul>                     | Berg: Ch.8 (cont.)<br>Word: Ch.7 (cont.)                  | <b>Assignment #6</b> – Data Modeling II, due next Tuesday before class.   |
| <b>Week 8.</b><br>Feb. 28<br>Mar. 2  | <b>Data Modeling (continued)</b> <ul style="list-style-type: none"> <li>• Creating Calculation Views</li> <li>• Calculation views (cont.)</li> </ul>   | Berg: Ch.8 (cont.)<br>Word: Ch.7 (cont.)                  | <b>Assignment #7</b> –Calculation Views, due next <b>Monday</b> before 5 pm.  |

| <b>Class</b>                          | <b>Topic</b>  | <b>Suggested Reading</b> | <b>Assignment</b>   |
|---------------------------------------|---|--------------------------|---|
| <b>Week 9.</b><br>Mar. 7<br>Mar. 9    | <b>Exam #2</b><br><ul style="list-style-type: none"> <li>• <b>Exam #2</b></li> <li>• Intro to SAP's Predictive Analytics Tool <ul style="list-style-type: none"> <li>- Time Series, and Regression Analyses</li> </ul> </li> </ul>  | Class notes              | <b>Case #3</b> – Evaluating Cognitive Analytics, due Tuesday, Mar. 21, before class.<br><br><b>Assignment #8</b> – Predictive Analytics I, due Thursday, Mar. 23, before class. |
| Mar. 12-19                            | <b>Spring Recess</b>  |                          |   |
| <b>Week 10.</b><br>Mar. 21<br>Mar. 23 | <b>SAP Predictive Analytics</b><br><ul style="list-style-type: none"> <li>• Discuss the Evaluating Cognitive Analytics case</li> <li>• SAP's Predictive Analytics Tool (cont.) <ul style="list-style-type: none"> <li>- Apriori and K-Means Analyses</li> </ul> </li> </ul> | Class notes              | <b>Assignment #9</b> – Predictive Analytics II, due next Tuesday, before class.   |
| <b>Week 11.</b><br>Mar. 28<br>Mar. 30 | <b>SAS Enterprise Miner</b><br><ul style="list-style-type: none"> <li>• Intro to Statistical Analysis System (SAS) for Analytics</li> <li>• Data exploration &amp; analysis using SAS Enterprise Miner</li> </ul>   | Class notes              | <b>Assignment #10</b> – Using SAS Enterprise Miner for Analysis, due next Tues., before class.  |
| <b>Week 12.</b><br>Apr. 4<br>Apr. 6   | <b>SAS Enterprise Miner (cont)</b><br><ul style="list-style-type: none"> <li>• Apriori analyses in SAS</li> <li>• K-Means analyses in SAS</li> </ul>  | Class notes              | <b>Assignment #11</b> – Enterprise Miner II, due next Tuesday, before class.  |
| <b>Week 13.</b><br>Apr. 11<br>Apr. 13 | <b>SAS Enterprise Miner (cont)</b><br><ul style="list-style-type: none"> <li>• Text Mining analysis using SAS</li> <li>• Time Series Analysis of time series data</li> </ul>  | Class notes              | <b>Assignment #12</b> – Enterprise Miner III, due next Tuesday, before class.<br><b>Final Project</b> available.  |
| <b>Week 14.</b><br>Apr. 18<br>Apr. 20 | <b>SAS Enterprise Miner (cont)</b><br><ul style="list-style-type: none"> <li>• Time Series analysis of transactional data</li> <li>• Regression analysis of continuous vs binary data</li> </ul>  | Class notes              | Continue working on Final Project.  |
| <b>Week 15.</b><br>Apr. 25<br>Apr. 27 | <b>SAS Analysis Game</b><br><ul style="list-style-type: none"> <li>• SAS Analysis Game</li> <li>• Course Review</li> </ul>  | --                       | <b>Final Project</b> , due this Friday, before 11:59 pm   |
| <b>Week 16.</b><br>May 10             | <b>Final Exam</b> – 2:00 -4:00 pm   |                          |   |

## Important University Information

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### Students with Disabilities - (213) 740-0776

Any Student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. - 2:00 p.m., Monday through Friday. <http://dsp.usc.edu>

### Incomplete and Missing Grades

A grade of Incomplete (IN) “is assigned when work is not completed because of documented illness or other ‘emergency’ occurring after the twelfth week of the semester (or 12th week equivalency for any course scheduled for less than 15 weeks).”

A grade of Missing Grade (MG) “should only be assigned in unique or unusual situations... for those cases in which a student does not complete work for the course before the semester ends. All missing grades must be resolved by the instructor through the Correction of Grade Process. One calendar year is allowed to resolve a MG. If an MG is not resolved [within] one year the grade is changed to [Unofficial Withdrawal] UW and will be calculated into the grade point average as zero grade points.

Please refer to: <http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html>

### Academic Conduct

***Sharing of course materials outside of the learning environment*** - USC has a policy that prohibits sharing of any synchronous and asynchronous course content outside of the learning environment. SCampus Section 11.12(B):

*Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes.*

***Plagiarism*** – is a serious academic offense with serious consequences

*Presenting someone else’s ideas as your own, either verbatim or recast in your own words.*

Students who plagiarize the work of other students or provide material for another student to copy, will receive zero points and **will be referred to** the Student Judicial Affairs and Community Standards (SJACS) board for further action. If SJACS determines the student violated the ethics codes, **the student will receive an F** in the course as suggested by the University. This is non-negotiable!!

Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b>.

Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>

## Support Systems:

***Counseling and Mental Health*** - (213) 740-9355 – 24/7 on call

<https://studenthealth.usc.edu/counseling>

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

***National Suicide Prevention Lifeline*** - 1 (800) 273-8255 – 24/7 on call

<http://suicidepreventionlifeline.org>

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

***Relationship and Sexual Violence Prevention Services (RSVP)*** - (213) 740-9355(WELL), press “0” after hours – 24/7 on call

<https://studenthealth.usc.edu/sexual-assault>

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

***Office of Equity and Diversity (OED)*** - (213) 740-5086 | Title IX – (213) 821-8298

<https://equity.usc.edu>, <http://titleix.usc.edu>

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

***Reporting Incidents of Bias or Harassment*** - (213) 740-5086 or (213) 821-8298

[https://usc-advocate.symplicity.com/care\\_report](https://usc-advocate.symplicity.com/care_report)

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, and response.

***USC Campus Support and Intervention*** - (213) 821-4710

<https://campussupport.usc.edu>

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

***Diversity at USC*** - (213) 740-2101

<https://diversity.usc.edu>

Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

***USC Emergency*** - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

<http://dps.usc.edu>, <http://emergency.usc.edu>

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

***USC Department of Public Safety*** - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

<http://dps.usc.edu>

Non-emergency assistance or information.