Data Warehouses
ITP 487 (3 Units) – Spring 2019

Course Description
While the increased capacity and availability of data gathering and storage systems have allowed enterprises to store more information than ever before, most organizations still lack the ability to effectively consolidate, arrange and analyze this vast amount of data. “Big Data” analytics has become a highly sought-after skill in business, engineering, services, science, health and other industries.

This course will explore the theory and practice of two major areas:
- Data warehouses for Enterprises
- Business Intelligence for Enterprise Resource Planning Systems (ERP)

Objectives
After completing the course, students will be able to
- Describe the components of an Enterprise data warehouse
- Model the relational database required for an enterprise data warehouse
- Extract, cleanse, consolidated, and transform heterogeneous data into a single enterprise data warehouse
- Analyze data to generate information and knowledge that lead to informed decisions for businesses
- Author enterprise dashboards that are used to summarize and visualize data in a way that supports insight into trends. Also, the ability to perform “what-if” analysis in real time.
- Show how ERP business intelligence can be derived from data warehouses
- Create standard reports for business users
- Derive insightful trends using data mining techniques

Concepts
Enterprise Data warehouses aim at physically framing multiple sources of data (e.g., databases and file collections) in an architecture that requires the mapping of data from one or more operational data sources to a target database management system (DBMS, e.g., Oracle) that supports the many decision-making processes and business intelligence (BI) systems of an enterprise.

Business Intelligence for ERP is the user-centered process of exploring data, data relationships and trends - thereby helping to improve overall decision making for enterprises. This involves an iterative process of accessing data (ideally stored in the enterprise data warehouse) and analyzing it, thereby deriving insights, drawing conclusions and communicating findings.
ERP System
SAP is the leading vendor of Enterprise Resource Planning Systems in the world. ITP/USC has a University Academic Alliance with SAP America for the past 19 years. Several ITP courses utilize the SAP system as a tool and platform for class projects and homework.

ITP 487 uses the SAP BW (Business Information Warehouse) tool extensively. All projects and exercises are conducted within the system. Students have the prerequisite exposure to SAP in their prior class. The data that is analyzed in ITP 487 comes from SAP ERP which is a transactional system. The tight integration of data between SAP ERP and SAP BW is key to skill building exercises in the course.

Prerequisites
ITP 320 or ITP 250

Lectures
Mondays 2:00PM to 4:50PM in VKC 203

Instructor
Mike Lee (mikelee@usc.edu)
Professor Office Hours: See http://bit.ly/professorlee

Teaching Assistant
Steven Pham (stevennp@usc.edu) & Kathy Deng (kathyden@usc.edu)

Website
http://blackboard.usc.edu
Course readings and assignments will be posted on Blackboard. Students should check for materials, deadlines, announcements regularly on Blackboard.

Information posted on blackboard will supersede information contained in this syllabus.

Textbook
http://store.epistemypress.com/books/analytics.html

Software
Most of the SAP software required for the class is Windows based. The software will be provisioned through the Viterbi Virtual Lab. Specifically, you will be using
- Teradata
- SAP GUI
- SAP BW (Business Warehouse)
- SAP BW Datawarehousing Workbench
• SAP BEx (Business Explorer Query Designer)
• SAP BusinessObjects Explorer
• SAP BusinessObjects Analysis
• SAP Business Objects Design Studio
• SAP Crystal Reports
• SAP InfoCube
• Microsoft Excel and Access

VITERBI VIRTUAL LAB – VMWARE VDI
All software can also be access to Virtual Desktop by logging in at: http://mydesktop.vlabs.usc.edu.
See blackboard for additonal instructions on installing.

**Grading**
The final grade will be based upon the total percentage earned. The weight of graded material during the semester is listed below. No extra credit assignments will be offered.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Participation</td>
<td>5%</td>
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<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Exam I</td>
<td>25%</td>
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<tr>
<td>Exam II</td>
<td>30%</td>
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<tr>
<td>Final Project</td>
<td>10%</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>100%</td>
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The following grading scale will be used to determine your letter grade:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>100-95</td>
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<tr>
<td>A-</td>
<td>95-92</td>
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<td>B+</td>
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<td>B</td>
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<td>B-</td>
<td>86-83</td>
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<td>C+</td>
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<td>C</td>
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<td>C-</td>
<td>77-74</td>
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<td>D+</td>
<td>74-71</td>
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<td>D</td>
<td>71-68</td>
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<td>D-</td>
<td>68-65</td>
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<td>F</td>
<td>65 or below</td>
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**Course Policies**

**Exams**
• The use of mobile devices, books, notes or computers is not permitted during the exam.
• No make-up exams will be offered except for documented medical or family emergencies.

**Homework**
• Students are encouraged to work with their classmates. However, students must turn in their own original work.
• Late homework submissions will be subject to a late penalty. The penalty is **25% per day**. No assignments will be accepted later than four days from the due date.
• All assignments must be submitted to Blackboard.

**Virtual Labs/Open Labs**
• Before logging off a computer, students must ensure that they have saved their. Any work saved to the computer will be erased after restarting the computer. ITP is not responsible for any work lost.
• ITP offers Open Lab use for all students enrolled in ITP classes. These open labs are held beginning the second week of classes through the last week of classes.

## Course Outline

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic(s)</th>
<th>Reading Assignment</th>
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<tbody>
<tr>
<td><strong>Week 1</strong></td>
<td><strong>1/7</strong></td>
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<td></td>
<td><strong>Lecture 0: Course Overview</strong></td>
<td><em>Reading Assignment:</em> None</td>
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<td></td>
<td><strong>Lecture 1: Introduction Data Warehousing and Business Intelligence</strong></td>
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<td></td>
<td>– Course objectives and outcomes</td>
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<tr>
<td></td>
<td>– Define business intelligence</td>
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<td>– Define data warehouse</td>
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<td>– Components of a data warehouse</td>
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<td>– Data mining</td>
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<td><strong>Week 2</strong></td>
<td><strong>1/14</strong></td>
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<td><strong>Lecture 2: Database Review</strong></td>
<td><em>Reading Assignment:</em> None</td>
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<td>– Components of a relational database</td>
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<td></td>
<td>– Entities, attributes, and relationships</td>
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<td>– Primary keys</td>
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<td>– Foreign keys</td>
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<td><strong>Week 3</strong></td>
<td><strong>1/21</strong></td>
<td><em>Homework:</em> Homework #1 – Analyzing Data with SQL on MS Access</td>
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<td><strong>NO CLASS – MARTIN LUTHER KING BIRTHDAY</strong></td>
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<td><strong>Week 4</strong></td>
<td><strong>1/28</strong></td>
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<td><strong>Lecture 3: SQL Review</strong></td>
<td><em>Reading Assignment:</em> None</td>
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<td>– Structure query language (SQL)</td>
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<td>– Creating databases, tables and rows</td>
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<td>– Querying databases</td>
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<td>– Basic calculations</td>
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<td>– Inner and outer joins</td>
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<td><strong>Week 5</strong></td>
<td><strong>2/4</strong></td>
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<td><strong>Lecture 4: Data Analytics Overview</strong></td>
<td><em>Reading Assignment:</em> Chapter 1: Kale</td>
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<td></td>
<td>– Course objectives and outcomes</td>
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<td></td>
<td>– Define data analytics</td>
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<td>– Making the case for analytics</td>
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<td>– Data driven decision making</td>
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<td></td>
<td>– Model Company - GBI</td>
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**Homework:**

- Homework #1 – Analyzing Data with SQL on MS Access
- Homework #2 – Analyzing Data with SQL on Teradata
- Homework #3 – SAP Business Explorer
| Week 6 2/11 | **Lecture 5: Data Acquisition**  
Source systems  
Data collection and staging  
Data representation for structured and unstructured data | **Reading Assignment:**  
Chapter 2 |
<table>
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<tbody>
<tr>
<td>Week 7 2/18</td>
<td><strong>NO CLASS – PRESIDENT’S HOLIDAY</strong></td>
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<tr>
<td>Week 8 2/25</td>
<td><strong>Exam I – DW, BI, Database &amp; SQL</strong></td>
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</table>
| Week 9 3/4 | **Lecture 6: Dimensional Data Modeling**  
Transaction systems vs. informational systems  
Data warehouses  
Multidimensional modeling  
Star schema and snowflake schema  
Fact and dimension tables | **Reading Assignment:**  
Chapter 3  
**Homework:**  
Homework #4 |
| Week 10 3/11 | **Lecture 6: Dimensional Data Modeling (cont)**  
Continued from previous lecture |
| Week 11 3/18 | **Lecture 7: Extraction, Transformation and Loading**  
Description of variables and constraints in the extended game  
Role of team members in the game  
Planning and forecasting for procurement, production and distribution  
Strategies for maximizing profits  
Interest and warehouse costs | **Reading Assignment:**  
Chapter 4  
**Homework:**  
Homework #5 |
| Week 12 3/25 | **Lecture 8: Slicing and Dicing**  
Basics of slicing and dicing  
Pivot tables  
Working with aggregation functions, hierarchies  
Exceptions and conditions  
Slicing and dicing multidimensional data (from cubes) | **Reading Assignment:**  
Chapter 5  
**Homework:**  
Homework #6 |
| Week 13 4/1 | **Lecture 9: Reporting**  
What are reports? Where are they used?  
Building reports from one or more data sources  
Formatting reports  
Creating summaries | **Reading Assignment:**  
Chapter 6  
**Homework:**  
Final Project |
| Week 14 4/8 | **Lecture 10: Dashboards**  
What are dashboards, cockpits, scorecards?  
How to author dashboards?  
Adding interactivity  
Deploying dashboards  
Mobile Apps for Analytics | **Reading Assignment:**  
Chapter 8 |
| Week 15 | Data Analytics Topics  
<table>
<thead>
<tr>
<th>4/15</th>
<th>Exam II Preview</th>
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<tbody>
<tr>
<td>Week 16</td>
<td>Exam II</td>
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<td>4/22</td>
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**Final Project Due: May 2**

Homework dates listed above are the assignment dates. Homework due dates will be posted on Blackboard.
Incomplete and Missing Grades

Excerpts for this section have been taken from the University Grading Handbook, located at http://www.usc.edu/dept/ARR/grades/gradinghandbook/index.html. Please see the link for more details on this and any other grading concerns.

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 a zero grade points.

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).”

Students with Disabilities

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 your course instructor (or TA) as early in the semester as possible. If you need accommodations for an exam, the form needs to be given to the instructor at least two weeks before the exam.

DSP is located in STU 301 and is open from 8:30am to 5:00pm, Monday through Friday. Contact info: 213-740-0776 (Phone), 213-740-6948 (TDD only), 213-740-8216 (FAX), ability@usc.edu, http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html.

Religious Holidays

University policy grants students excused absences from class for observance of religious holy days. Students should contact instructor IN ADVANCE to request such an excused absence. The student will be given an opportunity to make up work missed because of religious observance.

Students are advised to scan their syllabi at the beginning of each course to detect potential conflicts with their religious observances. Please note that this applies only to the sort of holy day that necessitates absence from class and/or whose religious requirements clearly conflict with aspects of academic performance. Please refer to the Holy Days Calendar http://orl.usc.edu/religiouslife/holydays/.

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. 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.
Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity [http://equity.usc.edu/](http://equity.usc.edu/) or to the Department of Public Safety [http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us](http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us). This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men [http://www.usc.edu/student-affairs/cwm/](http://www.usc.edu/student-affairs/cwm/) provides 24/7 confidential support, and the sexual assault resource center webpage [sarc@usc.edu](mailto:sarc@usc.edu) describes reporting options and other resources.

**Support Systems**

**Student Counseling Services (SCS)** - (213) 740-7711 – 24/7 on call  
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.  
https://engemannshc.usc.edu/counseling/

**National Suicide Prevention Lifeline** - 1-800-273-8255  
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [http://www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org)

**Relationship and Sexual Violence Prevention Services (RSVP)** - (213) 740-4900 - 24/7 on call  
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [https://engemannshc.usc.edu/rsvp/](https://engemannshc.usc.edu/rsvp/)

**Sexual Assault Resource Center**  
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: [http://sarc.usc.edu/](http://sarc.usc.edu/)

**Office of Equity and Diversity (OED)/Title IX Compliance** – (213) 740-5086  
Works with faculty, staff, visitors, applicants, and students around issues of protected class. [https://equity.usc.edu/](https://equity.usc.edu/)

**Bias Assessment Response and Support**  
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. [https://studentaffairs.usc.edu/bias-assessment-response-support/](https://studentaffairs.usc.edu/bias-assessment-response-support/)

**The Office of Disability Services and Programs**  
Provides certification for students with disabilities and helps arrange relevant accommodations. [http://dsp.usc.edu](http://dsp.usc.edu)

**Student Support and Advocacy** – (213) 821-4710  
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. [https://studentaffairs.usc.edu/ssa/](https://studentaffairs.usc.edu/ssa/)

**Diversity at USC**
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. https://diversity.usc.edu/

**USC Emergency Information**
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, http://emergency.usc.edu

**USC Department of Public Safety** – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.
Provides overall safety to USC community. [http://dps.usc.edu](http://dps.usc.edu)