Course Objectives:

This course is provides in-depth study of the design and implementation of the major components of a Database Management Systems (DBMS), and is a follow-up to the prerequisite course, COSI 127b. Students in this course will learn state-of-the-art approaches to systems design including: cost-based query optimization, lock-based and timestamp-based concurrency control, query, transaction and availability components of distributed databases, and niche data management systems such as data warehouses and stream processors.

Expected Outcomes:

Students who complete this course will be able to perform the following tasks:

1. simulate the actions of a cost-based query optimizer in processing a query, including: rewriting the query to a canonical form, generating a set of candidate plans for evaluating the query, applying formulas of a given cost model to cost candidate plans and choosing the plan with minimal predicted cost;

2. predict the outcome of a set of submitted transactions assuming both lock-based and timestamp-based concurrency control protocols;

3. predict the outcome of a set of submitted distributed transactions assuming two-phase commit concurrency control protocols;

4. simulate the actions of a log-based recovery system in response to a system failure occurring at any time;

5. apply their understanding of the above concepts to the implementation of a data management tool
**Logistics:**

**Where and When:**
- Meeting Place: Volen 105
- Meeting Times: Mon, Wed: 3:40-5

**Professor:**
- Mitch Cherniack ([mfc@brandeis.edu](mailto:mfc@brandeis.edu)), Volen 259
- Office Hours: Tue 4-5, Wed 5-6 (or by appointment).

**TAs:**
- Nga Tran ([nga@brandeis.edu](mailto:nga@brandeis.edu))
  - Office: Volen 109
  - Office Hours: TBD
- Zhibo Peng ([docp@brandeis.edu](mailto:docp@brandeis.edu))
  - Office and Office Hours: TBA
- Max Starobinets ([maxstar@brandeis.edu](mailto:maxstar@brandeis.edu))
  - Office and Office Hours: TBA

**Prerequisites:**

The prerequisite for COSI 128a is COSI 127b or permission of the instructor.

Those who have not taken COSI 127b can obtain permission to take this course by successfully completing a supplemental “catch-up course” work during the first month of class. The catch-up course will include:

- assigned readings from the text,
- a required problem set (to be completed by 9/20), and
- a required quiz (to be scheduled some evening during the week of 9/27)

Note that the requirements above are *in addition* to the other requirements of COSI 128 that are described below. The scores obtained in the catch-up problem set and catch-up quiz will be incorporated into the final grade for the course for affected students. The purpose of the catch-up course is to enable students who lack sufficient background to still take this course. All lectures will assume an understanding of many concepts that were covered in COSI 127b, so students who do not have this background will find otherwise find it extremely difficult to follow the lectures and complete the course.
requirements.

Resources:

We will use the same text for this course as we did for COSI 127: *Database System Concepts*, (5th or 6th edition), by Silberschatz, Korth and Sudarshan, published by McGraw-Hill. Copies can be bought online (http://www.amazon.com/Database-System-Concepts-Abraham-Silberschatz/dp/0073523321/ref=sr_1_1?s=books&ie=UTF8&qid=1282070281&sr=1-1) and two copies will be available on reserve. Occasionally, research papers may be assigned as supplementary readings. These will be made available from latte.

Slide content will often be borrowed from slides available at the textbook's web site at http://www.db-book.com. You're encouraged to download these files for your notes, but note that the slides and other materials presented in class may vary.

Evaluation:

Quizzes (~40%):

There will be 2 in-class quizzes -- one on 10/13 (Quiz #1) and one on 11/17 (Quiz #2). In addition, there will be a “catch-up” quiz (Quiz #0) for students who did take COSI 127b some evening during the week of 9/27. Taken together, the quizzes will be worth roughly 40% of your final grade.

Assignments (~15%):

There will be two written problem sets covering the material for which you will be responsible for each of the two quizzes above. The first problem set (PS 1) will be assigned on 9/20, due on 10/4 and will cover the material that can appear on Quiz #1 (10/13). The second problem set (PS 2) will be assigned on 10/27, due on 11/10 and will cover the material that can appear on Quiz #2 (11/17). Additionally, there will be a third problem set (PS 0) for students who did not take COSI 127b that will be assigned on 9/8, due on 9/20, and which will cover the material that can appear on the “catch-up” Quiz #0 (week of 9/27). Taken together, the problem sets will be worth roughly 15% of your final grade.
Collaboration will be permitted by students who are submitting a given problem set, but all submissions should still reflect each student’s own work. Thus, students may discuss their approaches to individual problems, but then should write up their solutions on their own. All problem set submissions should adhere to the following guidelines:

1. A cover page should be included that states your name and the names of all of your collaborators for that problem set.

2. Each problem should begin on a new sheet of paper to facilitate grading.

3. Your name should appear on every page of the assignment.

4. Pages of the assignment must be stapled together. Submissions that are not stapled risk having pages lost.

It is highly recommended that you photocopy your assignment for your own records prior to submission.

All problem sets are due by the start of class (3:40) on the problem set due date. Late submissions will lose one grade for each day or part thereof that they are late. To illustrate, an assignment which is due on Wednesday will be graded as follows. Assume that the assignment is worth an A before any late penalty is applied. If that assignment is turned in after 3:40 on Wednesday and at or before 3:40 on Thursday, then it will receive a B. If it is turned in after 3:40 on Thursday and at or before 3:40 on Friday, it will get a C etc.

**Final Project and Proposal (~45%)**:

The bulk of your grade will be determined by your final project. This requirement will have you work with a partner on an implementation of some project that relates to one or more topics discussed in this course and that has been approved by me. We will discuss some potential projects the week of 9/27.

You will be expected to think about your final project early. A brief (2-3 page) proposal that describes your proposed project will be due on 10/6, and will be worth roughly 10% of your project grade. The final project grade will be worth roughly 40% of your final grade, and must be “demo’d” (with accompanying executable source code, “read me” and project write-up) on the last day of class (12/6).

The Brandeis University policy on academic honesty is detailed in your Student Handbook under Rights and Responsibilities. Cheating or plagiarism will not be tolerated and will be prosecuted according to University guidelines.
Course Communication:

All course communication will take place via the course latte page, which you should be able to reach from http://latte.brandeis.edu once you register for the course.

The latte page will provide:

- all documents for the class (including this syllabus, problem sets and solutions, programming assignments and supplemental files and help session materials)
- class announcements (e.g., class cancelations)
- powerpoint slides for every lecture
- a forum (‘Questions for the Instructors’) for posting questions on the lectures, assignments. Note: the use of latte for posting questions is a way to both be fair to students in the class, as well as a way to save the time of your instructor and TA’s. It allows all questions and answers to be seen by all in the class, and helps to ensure that the same question does not get posed multiple times. Any questions on the course content or assignments that is not posed on latte will be ignored.
Schedule:

As best as possible, we will adhere to the schedule shown on the latte page for this course. Because some topics may require more time than is allotted, the lecture schedule may get modified as we get further into the course. Thus, keep track of this calendar on a regular basis. The reading assignments cover the material that is discussed that lecture. If you want to read ahead, you should read this material before coming to class.

A summary of important dates is shown below:

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>Mon, 8/30</td>
<td>First class</td>
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<tr>
<td>Mon, 9/6</td>
<td>No class (Labor Day)</td>
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<tr>
<td>Wed, 9/8</td>
<td>PS 0 Posted</td>
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<tr>
<td>Mon, 9/20</td>
<td>PS 0 Due, PS 1 Posted</td>
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<tr>
<td>Week of 9/27</td>
<td>Quiz #0</td>
</tr>
<tr>
<td>Mon, 10/4</td>
<td>PS 1 Due</td>
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<tr>
<td>Wed, 10/6</td>
<td>Final Project Proposals Due</td>
</tr>
<tr>
<td>Mon, 10/11</td>
<td>No class (Study for Quiz #1)</td>
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<tr>
<td>Wed, 10/13</td>
<td>Quiz #1</td>
</tr>
<tr>
<td>Wed, 10/27</td>
<td>PS 2 Posted</td>
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<tr>
<td>Wed, 11/10</td>
<td>PS 2 Due</td>
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<tr>
<td>Wed, 11/17</td>
<td>Quiz #2</td>
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<tr>
<td>Mon, 11/22</td>
<td>No class (Brandeis Thursday)</td>
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<tr>
<td>Wed, 11/24</td>
<td>No class (Thanksgiving)</td>
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<tr>
<td>Mon, 11/29</td>
<td>Last lecture</td>
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<tr>
<td>Wed, 12/1</td>
<td>Optional class (Work on final projects)</td>
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<tr>
<td>Mon, 12/6</td>
<td>Last class, Project presentations, write-ups due</td>
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</tbody>
</table>

Students with Disabilities:

If you are a student with a documented disability on record at Brandeis University and wish to have a reasonable accommodation made for you in this class, please see me immediately after the first class.