MOTIVATIONS AND OBJECTIVES

With easier availability of customer data, marketing is becoming increasingly customer-centric, i.e., marketers can identify and focus on the right customers (or cohorts of customers) for strategic advantage. Therefore, understanding and forecasting customer activity is a critically important exercise for all firms. In this course, we will learn:

1. How to use powerful models that use readily available customer activity data to understand patterns in customer behavior to inform cohort analysis;
2. How to provide accurate forecasts for what these customers will do in the future to calculate managerial, actionable quantities such as Customer Lifetime Value;
3. How to use these forecasts to inform customer management strategies, and to estimate cohort and company value.

Each class will start with a representative real-life problem which we will solve by the end of the class. The solutions, while powerful, will all be fully implementable in a standard spreadsheet package (like Microsoft Excel). Some of the problems that we will discuss in class are:

- How to project customer retention rates, such as for renewals in a subscription business;
- How to choose target customers in a direct marketing program;
- How to calculate the future profit from customers from early activity data;
- How to accurately calculate CLV/CAC, i.e., (Customer Lifetime Value)/(Customer Acquisition Cost), for different cohorts;
- How to tie the value of a firm’s customer base to its overall financial valuation (customer-based corporate valuation, or CBCV).
The course is useful for anyone who wants to understand and predict customer behavior as an input to strategy development. These include:

- modern marketing managers who use data-based insights to develop customer-centric strategies;
- entrepreneurs who want to understand the behavior of their customers;
- venture capitalists who want to ask smart and diagnostic questions about customer growth;
- consultants in the areas of marketing and strategy;
- financiers and valuation experts who want to understand customer-based corporate valuation (CBCV);
- analysts who want to be exposed to powerful customer-behavior forecasting models.

PRE-REQUISITES/CO-REQUISITES:
Students need sufficient mathematical background to handle the tools that will be introduced and discussed.

- The pre-requisites are: Marketing, Statistics, and Business Analytics in the core.
- At least one of these two courses is a pre-requisite or co-requisite: Business Analytics II, Applied Regression Analysis. (If you believe that you have taken or are taking a course similar to these two and want that to be considered as a pre-requisite or co-requisite, please feel free to contact me with your request.)

COURSE ORGANIZATION AND MATERIALS

The classes will be lecture-based, with a strong emphasis on real-time problem solving, including analytical exercises on the board and numerical investigations using Microsoft Excel. Central to the development of the skills associated with probability modeling is hands-on experience. To this end, a set of homework exercises will be assigned for some sessions. There is no formal textbook for the course, but lecture notes covering the material presented in class will be provided on a session-to-session basis. Excel spreadsheets used in class will be made available to the students, and some journal articles will be suggested as illustrations/applications of some of the techniques discussed. While it is expected that students will read and review all of these materials thoroughly, there will be no pre-class readings assigned for most sessions.

EVALUATION

Homework Exercises (60%): These exercises, which will be given (almost) weekly, will give you practice in applying concepts studied in class. All of the numerical work can be completed using Excel (although students are welcome to use other software packages if they wish to). All HW exercises fall under Category B2 (Individual with Discussions of Concepts Only).

Take Home Final Exam (20%): This will be a challenging and thought-provoking final exam will involve careful and creative application of the concepts studied in the course. The final exam falls under Category C (Individual).
**Class Participation (20%):** Every class will start with a real-life problem which we will solve and implement in Excel by the end of the class. Students are encouraged to be actively engaged in the lectures and to contribute actively in developing the solution. There will be occasional pre-class surveys that will also be graded.

## COURSE SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Class Topic</th>
<th>Due Before Class on Canvas</th>
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<tbody>
<tr>
<td>1/24</td>
<td>Introduction and Models for “Whether” (and “When”)</td>
<td>HW 0</td>
</tr>
<tr>
<td>1/31</td>
<td>Models for “How Many”</td>
<td>HW 1</td>
</tr>
<tr>
<td>2/7</td>
<td>Empirical Bayes Methods and Conditional Expectations</td>
<td>HW 2</td>
</tr>
<tr>
<td>2/14</td>
<td>Customer Lifetime Value</td>
<td>HW 3</td>
</tr>
<tr>
<td>2/21</td>
<td>Customer Lifetime Value Blue Apron case discussion</td>
<td>• Blue Apron Case pre-class survey (submit before 9 am)</td>
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<tr>
<td></td>
<td></td>
<td>• HW 4 (submit before class)</td>
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<tr>
<td>2/28</td>
<td>Customer-Based Corporate Valuation (CBCV)</td>
<td>CBCV Case pre-class survey (submit before 9 am)</td>
</tr>
<tr>
<td>TBD</td>
<td>Take Home Final Exam</td>
<td></td>
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## DETAILED COURSE CONTENTS

*Note: There is one lecture each week, 3 hours long with a 15-minute break.*

**Week 1: Introduction and Models for “Whether” (and “When”) (1 lecture)**

Motivating problems:
- Forecasting customer retention for a subscription-based service.

Tools and Concepts:
- General discussion about the philosophy and objectives of probability modeling.
- Comparisons to traditional regression-based models: “curve-fitting” vs. “model-building.”
- Highlights of the course.
- Models for choice data.
- Careful derivation of a parametric model for choice (the shifted-geometric, sG) and a parametric mixture model (the shifted-beta-geometric, sBG) using the beta distribution.
- Coverage of maximum likelihood estimation and the Microsoft Excel Solver tool.

**Week 2: Models for “How Many” (1 lecture)**

Motivating problems:
- Forecasting magazine readership.
- Forecasting customer donation incidence at a non-profit.
Tools and Concepts:
- Models for count data.
- The binomial distribution, the beta distribution, the beta-binomial model (BB).
- Generalizing the model to allow for “spikes.”
- Evaluating goodness-of-fit.

Week 3: Empirical Bayes Methods and Conditional Expectations (1 lecture)
Motivating problem:
- Understanding customer behavior over time at a wine seller

Tools and Concepts:
- Conditional distributions and expectations for choice and count processes.
- Combining population information (“priors”) with observed data for individuals.
- Regression-to-the-mean.

Weeks 4 and 5: Customer Lifetime Value (CLV) (2 lectures)
Motivating Problems:
- CLV at a subscription-based service and “The Perils of Ignoring Heterogeneity.”
- CLV at a non-profit.
- Case: CLV and Customer Management Strategy at Blue Apron

Tools and Concepts:
- Combining the basic building blocks to create integrated models to estimate customer lifetime value and related concepts.
- “Buy till you die” models:
  1. CLV in a contractual setting – sBG
  2. CLV in a non-contractual setting – BG/BB
- If time:
  - Other related BTYD models (Pareto/NBD, BG/NBD and PDO models).
  - Adapting basic models to privacy-preserving data formats (RCSS).

Week 6: Customer-Based Corporate Valuation (CBCV) (0.5 lecture)
Motivating Problem:
- How to tie the value of a firm's customer base to its overall financial valuation
- Guest lecture by Prof. Dan McCarthy (Professor of Marketing at Emory University; Co-founder of Theta Equity Partners and Zodiac; the world’s #1 CBCV expert)

Tools and Concepts:
- Models to combine CLV calculations across customers and across years

Week 6: Summary and Conclusion (0.5 lecture)
ATTENDANCE, CLASSROOM NORMS AND EXPECTATIONS

You are required to attend each class. If you want an excused absence, please contact OSA and ask them to send me an email (or forward their approval email to me).

Students are expected to adhere to CBS Core Culture in this class by being Present, Prepared, and Participating.

Laptops and cell phones are not allowed in class.

INCLUSION, ACCOMMODATIONS, AND SUPPORT FOR STUDENTS

At Columbia Business School, we believe that diversity strengthens any community or business model and brings it greater success. Columbia Business School is committed to providing all students with the equal opportunity to thrive in the classroom by providing a learning, living, and working environment free from discrimination, harassment, and bias on the basis of gender, sexual orientation, race, ethnicity, socioeconomic status, or ability.

Columbia Business School will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Columbia University’s Office of Disability Services for information about registration. Students seeking accommodation in the classroom may obtain information on the services offered by Columbia University’s Office of Disability Services online at www.health.columbia.edu/docs/services/ods/index.html or by contacting (212) 854-2388.

Columbia Business School is committed to maintaining a safe environment for students, staff and faculty. Because of this commitment and because of federal and state regulations, we must advise you that if you tell any of your instructors about sexual harassment or gender-based misconduct involving a member of the campus community, your instructor is required to report this information to a Title IX Coordinator. They will treat this information as private, but will need to follow up with you and possibly look into the matter. Counseling and Psychological Services, the Office of the University Chaplain, and the Ombuds Office for Gender-Based Misconduct are confidential resources available for students, staff and faculty. “Gender-based misconduct” includes sexual assault, stalking, sexual harassment, dating violence, domestic violence, sexual exploitation, and gender-based harassment. For more information, see http://sexualrespect.columbia.edu/gender-based-misconduct-policy-students.
ASSIGNMENTS

All of your assignment submissions are subject to the [CBS Honor Code](#). Violations of the CBS Honor Code may lead to failing the assignment, failing the course, suspension, and/or dismissal. In order to avoid ambiguity that may lead to unintentional violations of the Honor Code, assignment description types have been standardized and specified below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Grade</th>
<th>Preparation of Submission</th>
<th>Discussion of Submission*</th>
<th>Discussion of Concepts**</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Group Work</td>
<td>Same grade for all group members</td>
<td>By the group</td>
<td>Permitted to discuss (within group)</td>
<td>Permitted</td>
</tr>
<tr>
<td>B-</td>
<td>Individual w/ Discussions of Concepts and Submission</td>
<td>Individual grade</td>
<td>Individual preparation</td>
<td>Permitted to discuss; sharing solutions or submission files is not allowed</td>
<td>Permitted</td>
</tr>
<tr>
<td>B-</td>
<td>Individual w/ Discussions of Concepts Only</td>
<td>Individual grade</td>
<td>Individual preparation</td>
<td>Not permitted to share/discuss solutions or submission</td>
<td>Permitted</td>
</tr>
<tr>
<td>C</td>
<td>Individual</td>
<td>Individual grade</td>
<td>Individual preparation</td>
<td>Not permitted to share/discuss solutions or submission</td>
<td>Not permitted***</td>
</tr>
</tbody>
</table>

The designated group can be either an assigned study group or a self-selected one.

* Submission means any work and/or output pertaining to the specific assignment. If an assignment submission contains a calculation or decision related to a specific set of data and setting, discussing the details how to make this calculation or decision with regard the data/setting is to discuss the submission. Providing another student with a draft of the calculation or decision is sharing the submission.

** Concepts mean any ideas, examples, readings, or other related materials from the class/course. Conceptual discussion should not be based on a specific set of data or setting related to a calculation or decision required in the assignment, but could be based on other related examples, preferably those from class/course materials.

*** As no conceptual discussion is permitted, Type C is akin to a take-home exam.