

The Wharton School  
*UNIVERSITY OF PENNSYLVANIA*  
Department of Operations and Information Management  
Syllabus for OIDD 201 / OIDD 899

**Technology, Online Business Model Innovation, and Valuation**

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JMH 572 // Ext. 8-7747

Fall 2020

**Revised 30 July 2020**

Class Sessions: M, W 12:00-1:30

Office Hours: **M, W** 2-3:00 | **T** 11-11:45 and 1:30-3:00 | and by appointment

Class Assistants

TBD – [xxx](#)

TBD – [xxx](#)

Like all OIDD courses this quarter, this course will be **taught online**. Consistent with instructions from the Administration, **classes will be held live at the pre-scheduled class times**. Likewise, consistent with instructions from the administration, all classes will be **recorded**. There will be **additional supplemental materials** that will be **pre-recorded**. Office hours will be a combination of **scheduled** and **by appointment**, to accommodate students in different time zones.

This course provides an introduction to using simulation modeling to assess competitive strategies, to value online business models, and support valuation of online innovation. In particular it provides an introduction to formal analytical techniques for valuing business opportunities based on innovative use of information and technology. The content of the course will be divided among three areas: (1) Understanding the key concepts behind generating business opportunities for information-based strategies; (2) constructing, validating, and running computer-based models for the evaluation of innovative businesses; and (3) interpreting the output of computer simulation models for determining optimal strategies and evaluating innovative business opportunities. The course is intended to provide a foundation for further study in information-based strategies, online innovation, strategic consulting, and private equity, and of course for further study in OIDD. This course satisfies 1 credit unit in the new Wharton Undergraduate Flex Fundamentals / Technology Requirement and satisfies 1 credit unit in the MBA Business Analytics Major.

This course does not assume any prior experience in computer programming or in simulation modeling. The course does not require any prior study in information-based innovation or information-based strategy.

### **Course Objectives**

Students who complete the course will be prepared to find online business opportunities, evaluate new businesses as investment opportunities, and evaluate their own plans for online innovation.

### **Required Texts**

The primary text for the course is a small number of chapters selected from *New Patterns of Power and Profit: A Strategist's Guide to Competitive Advantage in the Age of Digital Transformation*. Students can choose between buying the text or buying the individual chapters online at Palgrave's website for the book. Students will also need to download the Goldsim User's Guide, which is available without charge online from Goldsim at [www.goldsim.com/Web/Downloads/UserManuals](http://www.goldsim.com/Web/Downloads/UserManuals). A few additional readings will be provided, primarily to augment students' understanding of the construction and use of computer simulation models.

### **Course Pedagogy and Philosophy**

Class time will be used for three very different purposes. The first use of class time is to provide in-depth discussion of the implications of key concepts covered in the readings; this is consistent with the design of most Wharton classes on strategy. The second purpose is to ensure that everyone is able to design and implement the computer simulation exercises assigned throughout the semester. I understand that this is a fairly intense programming course, and that many students will not have had experience with programming AND simulation AND debugging and running models for analysis of the evolution of dynamic strategies over time. We will use time together in the computer lab or using shared screen technology to assist students in developing and testing their models. The third use of class time is for the presentation of the results of simulation for strategy formulation and for the design and delivery of the strategic implications of the simulations to management. Collectively, these three activities support understanding online innovation and information-based strategy, support learning to construct and run models of online innovation and information-based strategy, and support using models to generate strategic insights.

A substantial portion of class time will be dedicated to assisting students in starting the construction of their simulation models. Likewise, a substantial portion of class time will be dedicated to discussing the strategic implications of these models. Wherever possible, assignments will be based on the instructor's actual consulting experience, framing and solving strategic problems for clients in a range of industries.

Note that there is some overlap between the readings for this course and for OIDD 210 and 613 but that the focus and principal learnings in this course are very different from the others.

### Assignments and Grading

There will be **one** mini-assignment just to ensure that everyone is able to start Goldsim and work with an existing Goldsim model. There will also be **six** additional computer-based simulation assignment during the semester. Please note that all readings and written assignments are highlighted in **gold** in the syllabus. Dates when computer assignments, models and documentation are due are noted in **blue**. Simulation assignments should all be done in groups of two or three students. Term projects can be done by larger groups of four or five students; larger groups for term projects can be formed with permission of the instructor.

Written assignments must be submitted electronically to the course Canvas website at the start of the class sessions in which they are due. Since assignments will usually be discussed in class on the date that they are due, it will not be possible to accept late assignments unless prior arrangements have been made.

There will be no examinations in this class. The final projects will serve as individualized final examinations. Assignments 1-7 will constitute 50% of your grade. The term project will be 50% of your grade. Class participation may contribute to course grades if the course is taught principally in the classroom; class participation will not be a significant portion of the grade if the course is principally taught virtually.

### Student Bios

Please submit a word file containing a short biographical sketch, not a full resume, via the Canvas website. Please title your attached file **I\_NAME.doc**, where **I** is your first initial, and **NAME** is your last name. Please provide the following information:

- your expected major at Wharton
- your experiences relevant to the topics of this course
- your experience with computer programming
- your reasons for taking this course and what you hope to get out of it

Please submit this by Wednesday, 9 September.

## Course Outline and Readings

1 W 2-Sept **Introduction to Simulation and Modeling for Business Insight**  
Introduction to simulation, to modeling, and to modeling for insight and judgment. Describe various types of simulations. Describing various purposes of simulation: as a chance to observe sensitivity of model to various assumptions, for models that are much more general and much more powerful than spreadsheets. Describing simulation as a form of experimentation. Describing iteration and Monte Carlo simulation as a form of experimentation.

The course uses simulation to value investments in the presence of risk and ambiguity, and why information systems innovations have high elements of both.

Why we use simulation, especially to deal with problems where our intuition breaks down and closed form mathematical analysis is not tractable, especially with randomness and feedback loops. Incorporate Forrester's original Sloan Management Review Article on limits to intuition in the social sciences.

Course Philosophy: Take real problems for strategy, especially from strategic consulting, and construct models to assess alternatives and make recommendations.

Describe the types of simulation: Stochastic vs deterministic // continuous flow vs. discrete event // examples of each // Overview of simple barbershop queueing in Pseudocode and in Goldsim.

Simple examples of simulations and the sort of outputs they produce.

Instructions for accessing Goldsim. You can install Goldsim on your Windows Machine or access Goldsim via a workspace at AWS provided by Wharton.

**Read:** <http://static.clexchange.org/ftp/documents/system-dynamics/SD1993-01CounterintuitiveBe.pdf>

**Read:** Online Goldsim Manual, Chapter 1

– M 7-Sept **No Class – Labor Day**

2 W 9-Sept **Introduction to Goldsim**  
Introduction to running Goldsim on your own PC or your AWS workspace. Starting Goldsim. Running a model. Toggling between run mode and edit mode. Entering parameter values. Viewing results, exploring results and various takeaways from Monte Carlo experiments. Inserting Pool element, Previous Value element, and adding flows.

Build and run Akerlof model in class. Show both the pseudocode and the final model. Vary the buyer's premium, vary the residual value, and examine the stability of Akerlof's insights. Adding History output.

**Assign:** (Mini-)Assignment 1 – Mini-assignment Exploring the Akerlof Model under a range of assumptions. Details on Canvas in Mini-Assignment under FILES / Notes. Learning Objectives: Understanding toggling between modes in Goldsim and understanding changing data values.

**Read:** Online Goldsim Manual, Chapter 2 (Skip advanced features)

### 3 M 14- Sept **Modeling for Insight – Understanding Problems with Growths and Depletions over Time**

We will discuss findings from running the Akerlof Mini-Assignment under different parameter values.

Discuss modeling for insight – working with a model to explore the implications, and why they are not immediately obvious in problems with stochastic elements and non-linear interactions.

Refining the problem statement. Creating a structural view of the problem. Identifying your decision and your decision criteria, and working backwards to identify your outputs. Creating an influence diagram for the problem. Identifying your certain inputs, your uncertain inputs, your stochastic inputs, and the functional relationships among them.

We will focus on how much detail is required in each model, and will relate the required amount of detail to the purpose of the simulation. We will address six critical questions:

1. When can I use *deterministic* data and when do I need *stochastic* data?
2. When do I need to examine behavior of *individual customers* or individual entities in the flows into and out of pools?
3. When do I need to examine *individual causes* of events or of flows in and out of a reservoir?
4. When can I use *aggregate probabilistic estimates* and when do I need to examine individual effects or individual groups separately?
5. When do I need to use *sensitivity analysis*?
6. When do I need to use *Monte Carlo* analysis and how is it different from sensitivity analysis?
7. When do I need to combine sensitivity analysis with Monte Carlo analysis?

Simple examples of simulations and the sort of outputs they produce. Show key entities and their interactions. Show the Yongle Golden Roof Tea Shop model as a simple example of pools with additions and

depletions. Show pseudocode. Show Goldsim. Show output. Show easy and difficult ways to change time steps and display steps in a continuous flow Goldsim model. Show how to switch between stochastic and deterministic models. Show how to create stochastic data elements. Construct the model together in class.

Explain the roles of sensitivity analysis and Monte Carlo analysis. Show how to force resampling of stochastic elements and how to define discrete and continuous distributions. Use of integrator element in place of reservoir to accept negative increases when necessary. Introduce the use of modeling for effective communication. Show how to use statistics and probabilities, as well as all “realizations,” to obtain extra information from Monte Carlo runs.

**Due:** Goldsim (Mini-)Assignment 1

**Due:** Formation of assignment teams on Canvas.

**Read:** Read Chapters 3 and Chapter 4 (skip Containers and Time Series) of Goldsim manual

**Read:** Online Goldsim Manual, Chapter 7, through **Running and Viewing the Simulation**

4 W 16-Sept **Modeling for Insight – Continuing to Build the Goldsim Model**  
We will complete building the deterministic Goldsim Model. We will add conditional events with starting and ending times. We will begin our treatment of stochastic variables and Monte Carlo analysis.

**Assign:** Assignment 2 Part 1 – Students need to create the Complete Deterministic Resonance *Golden Roof Yongle Tea Shop* Model. Learning objectives: Working with interactions over time. Details on Canvas in Assignment 2 Part 1 under FILES / Assignments.

**Read:** Clemons, article on the creation and modeling of fake news

5 M 21-Sept **Modeling for Insight – Building the Goldsim Model**  
Construct a simple model with multiple interactions. Learn to link reservoirs to stochastic and deterministic changes.

Use of displays for effective communication. Extracting as much information as possible from Goldsim outputs. The use of graphs and tables / charts. The use of statistics, probabilities, show all distributions, show single distribution.

**Assign:** Assignment 2 Part 2 – Students need to create the Complete Stochastic Resonance *Golden Roof Yongle Tea Shop* Model. Working with stochastic elements. Using Monte Carlo analysis to create confidence intervals for financial analyses. Details on Canvas in Assignment 3 under FILES / Assignments.

6 W 23-Sept **The Theory of Resonance Marketing**

Introduction to Resonance Marketing, and the transition from traditional market *fat spots* to resonance marketing *sweet spots*.

The key role of *informedness* and uncertainty reduction in enabling resonance marketing.

The role of feedback and organic online content – word of mouth increases customers, more customers increase word of mouth, more word of mouth increases customers.

Start Building Goldsim Model

**Read:** Online Goldsim Manual, Chapter 8 (first four sections)

**Read:** Read *New Patterns of Power* Chapter 4.

**Due:** Assignment 2 Part 1 – Deterministic Yongle Tea Shop.

7 M 28-Sept **Resonance Marketing Analysis of Yongle Tea Shop plus Modeling Competition: Use of Vector Elements in Goldsim and Design of Displays for Decision Making**

Class presentation of results from Yongle Tea Shop.

Modeling for effective communication. Significance of Monte Carlo findings when negotiating with bankers. Significance of the Orange Raccoon Lion Hair problem, and the significance of timing. Is it better to have this disaster early or late? Does it depend on your need for credit early? Does it depend on the timing of your exit strategy?

Begin discussion of use of models with two or more reservoirs to study competition and changing balance between two firms. The original problem – Are promotions truly zero sum? If not, why not? Should the weaker player continue promotions even if the stronger player does not? Describe the *Gas Diffusion* model of promotions as introduced at Lever Brothers. Begin construction of the two pool model of promotions.

**Read:** Online Goldsim Manual, Chapter 10, Section on “Using Vectors and Matrices”

**Due:** Assignment 2 Part 2 – Stochastic Yongle Tea Shop, with multiple scenarios, with and without Monte Carlo statistics.

**Assign:** Assignment 3 Part 1 – Students need to create the complete deterministic and stochastic *Gas Diffusion* models for brand switching. Learning objectives: Working with multiple pools to model changing competitive balance between and among firms. Details on Canvas in Assignment 3Part1 under FILES / Assignments.

8 W 30-Sept **Matrices and Pools and Tricks for Extending Matrix Capabilities in Goldsim, Plus the Use of Dashboards**

Review of complex stochastic triggers in Goldsim. In-depth exploration of resonance marketing.

Dashboards are especially useful for submitting work to clients or members of the executive team. They make it very easy for someone to enter data into the model and see the results. Entering data in a dashboard is much easier than entering data into data elements. Seeing *all* of the key graphs at once likewise makes the model much easier to use.

**Assign:** Assignment 3 Part 2 – Students need to augment the stochastic *Gas Diffusion* model for brand switching to accommodate the erosion of brand loyalty and the advent of Private Label products. Learning objectives: Introduce greater complexity when more than two firms compete, and when firms compete with very different strategies. Set up the discussion of newly vulnerable markets. Details on Canvas in Assignment 3Part2 under FILES / Assignments.

9 M 5-Oct **Theory of Newly Vulnerable Markets – Modeling Capital One's Attack on Dominant Players**

Begin discussion of Newly Vulnerable Markets and available strategies for defenders.

Key concepts in Newly Vulnerable Markets: Markets that are newly easy to enter, attractive to attack, and difficult to defend. Conditions under which newly vulnerable markets arise. Difficulty in developing an effective strategy in response to attack. Trap of the vanishing status quo and difficulty in explaining to management how to respond when all of the options seem to be worse than where you are now.

Newly vulnerable markets as an opportunity for new entrants to attack industries that appear mature and invulnerable to attack from small competitors.

Describe *death spiral* and behavior of NVMs over time.

Describe behavior in terms of activities: *In Play Ratio*, *Defection Rate*, *Retention Effectiveness* through Offer Matching, and *Preemption Effectiveness* by Offer Matching.

Describe managerial strategies for incumbents to respond to attack, from *ignore*, *preempt*, *retention*.

Note to start thinking about term projects. You will learn more complex means of processing vectors. You will learn more about



creating dashboard displays. Think about a problem in dynamic evolving strategy that interests you enough to engage in serious study.

**Read:** Newly Vulnerable Markets / Chapter 2, Sections 2.1 – 2.4 in *New Patterns of Power and Profit* or Capital One Case Study on Canvas in FILES / Notes

**Read:** Read *New Patterns of Power* Chapters 1 and 2.

**Due:** Assignment 3 Part 1 – Gas Diffusion Model of Brand Switching without erosion of Brand Loyalty.

10 W 7-Oct **Complete the Discussion of Gas Diffusion Model of Promotions and the Introduction of Private Label / Begin Modeling Capital One's Attack on Dominant Players as an Example of Newly Vulnerable Markets**

Present model of switching under the effects of promotions, adding in erosion of loyalty to all brands as a result of shopping on the basis of price during promotions. This serves as an introduction to newly vulnerable markets.

Start to build a simulation of the Capital One attack on Citi. What do we want to know about the behavior of customers and what behaviors we need to include in the model? What can executives do to influence customer behavior?

What do we need to show in order to answer questions and influence behavior of executives and their selection of strategies?

Complete description of the model. Then build the multi-pool model, with different *in-play ratios* and different switching rates, and with different retention rates. Explore retention APR and pre-emption APR. Start building the model.

**Assign:** Assignment 4 – Newly Vulnerable Markets at Citi. Learning objectives: Working with multiple pools to model changing competitive balance between and among firms when engaging in more complex strategies. Learning how to extract information from models that will be essential for managerial decision making. Learning how to present to management when there are no good options. Details on Canvas in Assignment 4 under FILES / Notes.

**Assign:** Final Term Project Assigned. Students prepare to present proposals.

**Due:** Assignment 3 Part 2 – Gas Diffusion Model of Brand Switching with Erosion of Brand Loyalty and the Introduction of Private Label.

- 11 M 12-Oct **Theory of Newly Vulnerable Online Markets**  
Begin discussion of the theory of newly vulnerable online markets as an extension of the theory of Newly Vulnerable Markets. Discussion of traditional manufacturers' direct attack on their retail channel and of the stores' possible responses. Discussion of airlines' attack on agency-based sales and theory of the agencies' available responses.  
  
Begin Development of the Model of Capital One's attack on Citi, including introduction to more complex use of vectors
- 12 W 14-Oct Continue Modeling Theory of Newly Vulnerable Markets  
Continue Development of the Model of Capital One's attack on Citi
- 13 M 19-Oct **Continue Theory of Newly Vulnerable Online Markets**  
Theory of newly vulnerable online markets. Theory of the brand's attack on the store. Theory of the store's response. Theory of the airlines' attack on agency-based sales and theory of the agencies' available responses.  
  
Role of the *in-play* ratio.  
  
Extensions to insurance, investment advising, and other product markets. When is the cooperation of the traditional channel truly essential to the provider of the goods or services? What does this tell us about the role of the channel in *inspection goods*, distinct from the role of the channel in standardized commodity goods?
- 14 W 21-Oct **Modeling Attack on Newly Vulnerable Online Markets**  
Begin construction of model.  
  
Use of multiple pools for each brand (enthusiastic, loyal, and indifferent customers), with different willingness to pay. Subdivide each pool based on attitude towards and experience with online shopping, with different willingness to pay for online shopping. Model skeptical adoption and different willingness to pay for inexperienced and experienced online shoppers. Review the complex logic needed to model the behavior of vector pools in the absence of vector-valued selector elements.  
  
Return of the *in-play ratio*.
- Assign:** Assignment 5 Part 1 – Newly Vulnerable Online Markets and eLever vs. Wal-Mart, AKA the *Battle between Plover and Brindle for Wal-Mart's Affection*. Learning objectives: Understanding multiple complex relationships between multiple pools. Understanding the difficulty of a single manufacturer launching an attack on an established retail channel. This will be a hybrid assignment, with students responsible for most of the code. The most difficult segments of code will be

provided by the instructor. Students will be required to use the model to derive managerial insights. Details on Canvas in Assignment 5 Part 1 under FILES / Notes.

**Due:** Assignment 4 – Newly Vulnerable Markets at Citi.

15 M 26-Oct **Modeling Traditional Consumer Goods Company's Attack on Traditional Retail Channel**

Discussion of Capital One's attack on Citi. Discussion of presentation of options when there are no good options. Trap of the vanishing status quo as an obstacle to effective response to emerging threats.

Continue construction of model of newly vulnerable online markets.

What else do you need to know? Modeling pools, flows, and influences. Most complex part of the model: determining what each customer Group will do (6 groups), facing three purchase choices (Plover, Plover Online, or Brindle), with three prices, and three sets of willingness to pay numbers. Customers are originally reluctant to shop online, but if encouraged to try by sufficiently attractive promotional prices they can be converted to repeat shoppers.

**Assign:** Assignment 5 Part 2 – Newly Vulnerable Online Markets and eBritish Airways vs. American Express, AKA the *Battle between Plover and Brindle for Travel Agencies' Affection*. Learning objectives: Understanding multiple complex relationships between multiple pools. Understanding the difficulty of a single manufacturer launching an attack on an established retail channel. This assignment will not require the construction of a model. Students will be given a model and required to use the model to derive managerial insights. Details on Canvas in Assignment 5 Part 1 under FILES / Notes.

**Due:** Assignment 4 – Capital One's Attack on Citi.

16 W 28-Oct Examples of Simulations Suitable for Term Projects: Modeling Government Policies for Regulating Fake News, Modeling the Impact of Covid-19 at Penn in the Presence of Mitigation, Modeling Impact of Selective Social Distancing while Waiting for Vaccine Development

17 M 2-Nov **Discussion of Proposed Term Projects**

Student presentation of their term project proposals. What is the question you want to answer? What data values do you need to know in order to answer the question? What do you need to know in order to build the model? What do you already know about the structure of your model? Why does this require simulation?

**Due:** Term Paper Proposal Power Point Presentations.

- 18 W 4-Nov **Discussion of Proposed Term Projects Continued**  
Student presentation of their term project proposals. What is the question you want to answer? What data values do you need to know in order to answer the question? What do you need to know in order to build the model? What do you already know about the structure of your model? Why does this require simulation?
- 19 M 9-Nov **Discussion of Proposed Term Projects Continued**  
Student presentation of their term project proposals. What is the question you want to answer? What data values do you need to know in order to answer the question? What do you need to know in order to build the model? What do you already know about the structure of your model? Why does this require simulation?
- 20 W 11-Nov **Introduction to Queuing and Discrete Event Simulations**  
Begin discussion of the basic elements of a discrete event queueing simulation and highlight the principal differences between discrete event and continuous flow simulation models.  
  
Start of simple queueing model. Introduce the necessary elements, random arrivals (stochastic variable linked to yellow bolt clock icon), timed operations (timed delays as yellow bolt hourglass icons), discrete changes (red bolt). Link them into pools of customers, pools of servers. This will be traditional lecture format.  
  
Start discussion of a simple barbershop queueing model.
- Due:** Assignment 5 Parts 1 and 2 – Newly Vulnerable Online Markets and Lever vs. Wal-Mart and Newly Vulnerable Online Markets and eBritish Airways vs. American Express.
- Read:** Online Goldsim Manual, Chapter 8 (first four sections)
- Read:** Design of a well-structured simulation model
- Assign:** Assignment 6 – Traditional queueing simulation, using a barbershop with multiple barbers, time-varying arrivals, time-varying staffing levels, priorities among customers, and with additional optional services. Learning objectives: Understanding the optimal levels of servers in discrete event simulation. Understanding the impact of priority service rules. Understanding the role of variable server counts throughout the service day. Understanding sequential queues, where completing one service places job in queue for a second service. Students will not be expected to construct the simulation model. They will be expected to be able to use the model I prepare and to obtain results from my model. These results will enable them to assess

optimal configuration of the shop under alternative sets of assumptions posed by questions in the assignment.

- F 13-Nov **Revised Term Paper Proposals <<This is not a class session. This is an opportunity to submit revised proposals for additional feedback if desired>>**

Submission of term paper proposals, revised after individual discussions if groups want additional feedback.

**Due:** Optional Revised Term Paper Proposals from groups that want additional feedback

- 21 M 16-Nov **Analysis of Attacks on Traditional Distribution Channels Plus Introduction to Queuing and Discrete Event Simulations Continued**  
Completion of the barbershop queuing model, including examination of the construction of individual elements.

Introduction of sequenced queues and parallel queues in a full service barbershop. Implementation of priority queueing rules.

- 22 W 18-Nov **Discussion of a Queuing Model for Service Organizations**  
I will discuss a model for the simulation of a traditional service organization with varying levels of demand and varying levels of servers, with parallel queues, multiple job steps, and priority sequencing of jobs from different clients. Students will need to understand this model well enough to work with it and obtain insights from it but will not be required to build this model.

- 23 W 23-Nov **Validation and Verification of Queuing Models Plus Analysis of Service Organization**  
Validation, verification, and debugging in queuing models using the barbershop model. I will provide models with bugs, and I will use output data to find the bugs.

We will do this interactively, using Goldsim.

Discussion of simulation model results in traditional lecture format. We will delay discussion if necessary to allow all student groups to complete Assignment 7.

Due date can be flexible if necessary.

**Due:** Assignment 6 – Optimal Staffing Levels in a Complex Model of Queuing in a Service Organization

- W 25-Nov No Class – University is on a Friday Schedule

- 24 M 30-Nov **Supervised Work on Final Projects**

- 25 W 2-Dec **Supervised Work on Final Projects**
- 26 M 7-Dec **Introduction to Social Welfare Computing: The Costs and Benefits of Sponsored (Paid) Search**  
Modeling complex social problems – the problem of sponsored search. Understanding the power of mandatory participation third party payer business models (MP3PPs). Understanding the power of MP3PP Online Gateways. Understanding the tradeoffs involved with free search combined with MP3PP gateway power.
- 27 W 9-Dec **Class Summary**  
Review of key concepts. Modeling for judgment, intuition, and insight. Uses of continuous flow and discrete event simulation. Uses of stochastic and deterministic simulation. Role of Monte Carlo experimentation for distributions and confidence levels. Importance of sensitivity analysis. Importance of graphics and sensitivity analysis in final recommendations.
- X XX-Dec **Final Projects Due**  
We will no longer require presentations of final projects but final projects will be due at the end of the day XX December when the exam would have been scheduled. Final projects presentations will be optional, and scheduled for any groups that want to present, between XX and XX, at the time reserved for the Final Exam. I will also be available for private meetings between the end of class on 9 December and the due date for the final project, for any groups that want to schedule time for additional supervised work with me.