



SENIOR DESIGN OVERVIEW

Purpose

The purpose of this document is to describe the OREM *Senior Design* projects course as a first step for prospective industry organizations to be introduced to the program. The course basics are detailed below so these organizations can begin to evaluate whether they might have an interest and ability to participate, and if so, where to obtain further information.

The Senior Design Process

Each spring, SMU seniors majoring in Management Science from the Lyle School of Engineering complete a capstone project for the course OREM 4395 *Senior Design*. In this semester-long class, each team identifies and completes a consulting engagement with a client organization from the community to apply their analytical training to a real client problem. They deliver a solution in the form of a final report, presentation, and any developed software. Projects are welcome from organizations of all types: corporations, non-profits, and government agencies.

Each senior design project follows four phases: project selection, design and analysis, implementation, and delivery. Details for each phase are outlined below, followed by a list of frequently asked questions and answers.

1. Project Selection Phase
 - a. Faculty advisor works with client to identify potential projects for *OREM 4395 Senior Design* student groups within their organizations. Students may independently work to identify clients and project topics for their team.
 - b. Students work in teams with faculty advisor to identify / select projects based on group's interests. (Note: projects sourced from faculty advisor's *or* students' contacts)
 - c. After student group selects project, an initial project kickoff meeting is scheduled with client, student group, and faculty advisor
 - d. During initial meeting, all stakeholders will help define project topic / problem and scope
2. Design and Analysis Phase
 - a. Working in conjunction with faculty advisor, students design possible solution approaches and determine data needs
 - b. Data collection process begins:

- If data is readily available, client provides to students
- Otherwise, students work with client to collect necessary data
- c. Ensuring project guidance, direction, and feedback:
 - Students meet with faculty advisor *weekly* to discuss progress, issues, next steps etc.
 - Students meet with client as needed for feedback and troubleshooting
- 3. Implementation Phase (under supervision of faculty advisor)
 - a. Students develop mathematical / statistical models necessary for analyzing problem
 - b. Students test and validate models
 - c. Students apply models to data, socializing results with client and faculty advisor
 - d. Ensuring project guidance, direction, and feedback:
 - Students meet with faculty advisor *weekly* to discuss progress, issues etc.
 - Students meet with client as needed for feedback and troubleshooting
- 4. Delivery Phase
 - a. Students interpret results / draw conclusions from models output combined with any other qualitative observations
 - b. Students prepare recommendations and deliverables for client: final report, formal presentation, and any software created / data gathered
 - c. Deliverables are given to the client, who provides feedback to the student team and faculty advisor

Frequently Asked Questions

The Senior Design Course

1. *What is the goal of this capstone course and project?*

The objectives are to give students experience in applying the Management Science methods that they have been studying and working as a team to complete a consulting project for an actual client. It is a preview of life after graduation in a common work format that involves clients, teamwork, uncertainty, deadlines, and deliverables.

Projects

2. *What constitutes an appropriate project topic?*

A senior design project involves the application of quantitative analytical methods (that is, has a mathematical or statistical dimension) for optimization, prediction, or decision-making. The topic can be accomplished in three months and is typically not mission-critical to the client.

3. *What might not be an appropriate topic?*

Topics that do not involve analytics do not qualify, such as straight computer programming, clerical work, building a database, or designing a web site. However, projects often involve data collection or creating a data set to test a model that was programmed by the team to address the client's problem.

4. *What is the timing and duration for a senior project?*

Senior projects can begin in January and must be completed by the first week of May.

5. *How is the project scope determined?*

The faculty advisor works with the client and students to set the proper scope. Overly ambitious projects will need to be reduced in scope by focusing on a smaller population, region, or aspect of the full problem. Simple problems are expanded to merit credit for a capstone course. The size of the team will affect what are reasonable expectations and reasonable goals.

Student Teams

6. *What is the cost of having a student team work on my project?*
While the work is done pro bono as a service to the community, some clients have chosen to make a tax-deductible donation in appreciation for the work performed.
7. *How many students are on a team and how many teams are there?*
Teams range in size from two to four, depending on the problem complexity. For Spring 2014, there were 48 seniors organized into around 20 project teams .
8. *What kind of students are typically on a team?*
These men and women have nearly completed a bachelor's in Management Science, with courses in operations research, probability/statistics, production /operations management, computer science, mathematics, economics, management, entrepreneurship, and engineering communications. Their career paths are diverse and include consulting, defense, manufacturing, logistics, entertainment, finance, and telecommunications. Post-graduation job titles include analyst (many types), systems engineer, and manager. Many go on to complete a masters in Operations Research, Systems Engineering, Information Engineering, or Engineering Management.
9. *How many hours does the team work on a project in a typical week?*
Although it varies over the project term, teams average at least ten hours per week, but some spend much more time during critical junctures.

Faculty Advisors

10. *What is the role of the faculty advisor?*
The faculty advisor works with both clients and students to (1) identify appropriate projects,
(2) develop a reasonable project scope, (3) identify an appropriate solution approach and resources needed to complete the work, and (4) provide project oversight and technical expertise throughout.
11. *Who is the faculty advisor?*
In Spring 2024, the course advisors are: Dr. Richard Barr¹ and Dr. Eli Olinick, full-time OREM faculty members with significant industry experience in the application of analytics.
12. *Who should I contact about a potential senior project?*
You should contact an instructor to discuss a project.

Client Responsibilities

13. *What are my responsibilities as a project client?*

¹ Richard Barr (B.S.E.E., M.B.A, Ph.D., University of Texas at Austin) is an Associate Professor of the Engineering Management, Information, and Systems department at Southern Methodist University's Lyle School of Engineering, Dallas, Texas. Dr. Barr's research interests include large-scale optimization, network software for telecommunications and logistics, benchmarking models, prescriptive analytics, and optimization-based data mining. His business background includes the establishment of several start-up companies, venture capital funding, and a consulting practice whose client list includes CONRAIL, Coopers & Lybrand, Cray Research, E-Systems, General Motors, The Heritage Foundation, IBM, Peat Marwick Main & Co., Raytheon, The Tax Foundation, U.S. Air Force, U.S. Navy, and the U.S. Departments of Commerce, Health and Human Services, Interior, and Treasury. He has managed over 200 senior design projects involving approximately 600 students.

During the Project Selection phase, the client will work with their staff, the course advisor, and students to identify and scope an appropriate project; this may be done prior to or during the client-hosted kickoff meeting with all involved parties. A primary Point of Contact (PoC) should be designated. During the Design and Analysis and Execution phases, the PoC will need to provide the team with data, expertise, and guidance on requirements and relevant process specifics and have time to meet on a regular basis. Upon project completion, the client will provide the team and advisor a brief evaluation of the resulting work product.

14. *The project might involve the use of sensitive data or systems. How might this be handled?*

If the data is sensitive, a solution can be developed and tested on masked/redacted, hypothetical, old non-sensitive, or publicly available data sets. The client can later apply the solution system to operating data. If the project involves a proprietary or sensitive process, we can mask the organization's name, not publish the results, and, if necessary, sign a non-disclosure agreement in which clients must approve any releases of information. Students will need to be able to present their results to the rest of the class.

Example Results

15. *Can I see some example outputs from a project team?*

Yes. The Senior Design Archive site (smu.edu/srdesign) contains a sample of previous projects, including some with final reports and presentations.