OPRE 6302: Operations Management
Fall 2016
Professor Kathryn E. Stecke
Course Pack

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   to either determine a time to see me or to   **Thursdays 2:00 PM - 4:00 PM**
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Course Standards

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1. <u>Attendance</u>. Class attendance is mandatory. If you must be absent due to illness or some emergency, please let me know so that your absence is not unexplained.

2. <u>Preparation</u>. I'll expect you to be well prepared for each class--this is necessary if the case method is to be its most effective and enjoyable. If for reasons out of your control you are unable to prepare adequately for a class, please attend anyway. If you wish, please tell me before class that you are unprepared. (This is to avoid calling on you, not to penalize you.)

3. <u>Participation</u>. I expect <u>each</u> of you to be participants in discussions during the course. I view any comment--<u>including questions</u>--as worthwhile, as long as it doesn't interrupt the flow of the discussion by reverting to a point long-since passed. Good participation adds to our collective learning. I feel that developing your communications skills, both oral and written is an important part of your MBA training, a part that will stay with you and serve you better and longer than most of the technical content you will learn. That is why I encourage participation and reward effective written presentation on exams. I expect <u>the class to help</u> deal with people who may be monopolizing discussions without adding to their classmates' learning.

4. <u>Laptops and Cell Phones</u>. Computers are not useful for our case discussions. I know that some students like to take notes in class on their computers. Every term, some students come to me to complain that the sounds from laptop users are highly distracting to them. There is research that shows that learning is enhanced from the process of manually taking notes in class. Therefore, laptop use is not allowed. Also, cell phones should be turned off.

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Evaluation

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The components of your grade are Midterm Exam, Final Exam, and Class Participation. They are weighted 40%, 40%, and 20%, respectively. Notations (that I make after each class) on your class cards and on my class list will remind me at the end of the semester of your class participation during the semester. I grade on a curve and I look for breakpoints on the total points curve. Plusses and minuses are given. Exams are closed-book, no notes. Calculators (not cell phones) may be used.

Written work is blind-graded: names are covered so that I do not know whose work I am grading. I do this so that I do not subconsciously double-count class participation when reading the exams. I use a precise grading key when evaluating written work, to maximize uniformity in grading.

Further Comments on Class Participation

Case-method courses are most effective when many students' viewpoints are represented. Moreover, classes are more fun for all of us (including me) if discussions are not dominated by 5-10 people. Accordingly, I make a conscious effort in class to call on people who have not spoken earlier in the discussion and/or who have been infrequent participants to that point in the course. But it is also your obligation to ensure that a few don't monopolize the discussions--if only the same hands are always raised, it does happen that I tend to call on those people. (If you feel I am not seeing your hand, please tell me; I do not consciously avoid calling on anyone, but I may have "blind spots" in the classroom and you may be sitting in one of them).

Some cases do not have "right answers", while others do. But being "right" or "wrong" should not be your concern when participating--or deciding whether to add a comment. We are interested in your point of view and if there is a later consensus that differs from your viewpoint, that in no way diminishes the value of your earlier comments, nor does it in any way demean you as an individual. For example, I feel some of the best (in terms of everyone's learning) class discussions I have led have involved a student's presenting and incorrect set of calculations or taking a conceptually faulty approach. To reiterate my earlier comments, I view all comments or questions as worthwhile, unless they revert to a point long-since passed in the discussion.

This does not mean, however, that you should not be a critical listener to your fellow students' comments or mine. If you disagree with what someone has said, then speak up and explain how and why your viewpoint differs. I do not think that disagreeing with our questioning what someone has said somehow diminishes that person's worth or as an individual. I will try to be critical of class comments, and I expect you to be also. You should realize that after graduation, your MBA degree will not shield you from other's critical appraisal of your viewpoints--indeed in many instances your MBA will set you apart as someone to be "tested" as to how strongly you believe in your own comments and/or how thoroughly you have thought about an issue. I firmly believe you should be exposed to this sort of "critique environment" as part of your MBA training, which is why I try to challenge your comments and why I hope you will question each other. In fact, effective people seek out their peers' reactions to what they have said or written (e.g., critical discussion of a management consultant's proposed recommendations or of a draft manuscript for a professional journal), for: (1) they know that their ideas and/or ways of expressing them can be improved upon; and (2) they know that critiques of their work make them more valuable individuals, not less.

Even though there may not always be a "right" solution to a case, I will usually share with you my views on a case's issues and ways of resolving them. I do this not to impose a "preferred solution" on you, but because I feel--and most of you agree--that I have a responsibility as a person experienced in this field to let you hear my viewpoint.

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Syllabus and Assignments

Required: Supplemental Course Pack (abbreviated hereafter as **CP**).

Office Hours: Due to the difficulty that evening students have in making scheduled office hours, I have office hours by appointment. Please call me at (972) 883-4781, or email me.

Comments on the Course

Operations Management is concerned with the *efficient transformation of inputs into outputs that will effectively achieve customer satisfaction.* Inputs are materials, labor, capital, and management. Outputs are products or services, which customers want and are willing to pay for. The transformation or conversion process is the topic of this course.

The **objectives** of this course are to:

1. Expose you to a range of operations settings so that you:

   a. Will *understand the role of operations* and how operations support the business objectives and interact with other functions in pursuit of an organization's vision.

   b. Will *understand how operations affect* you, other people, and society.

   c. Can *appreciate* the complexity, excitement, challenge, and creativity associated with managing operations.

2. *Develop your ability* to analyze operations processes, and the management of quality and   productivity. The following *skill set is* of paramount importance:

   a. *Understanding* how to *diagnose* an operation.

   b. *Assessing* the quality and productivity of an operation and the degree to which it is consistent with the organization's strategy and consumer needs;

   c. *Defining* and *organizing* ill-structured operations problems so they are analyzable and solvable;

   d. *Developing* an implementable *action plan.*

3. Introduce the various types of production processes and the key issues in managing these processes.

4. Introduce some quantitative techniques and demonstrate their use in analyzing production systems and solving operations problems.

5. Address commonly occurring application areas such as production and worker scheduling and inventory control and to present some of the best-known and useful results in these areas.

6. Cover current topics of national concern, relating to quality issues and manufacturing strategy, for example.

You will be asked to prepare a case or two for most of the sessions of the course. These cases will provide basis for our discussion during class.

When asked to "prepare" a case, you should do the following:

--   Read the case: Then ask yourself, "What are the issues here?" That is, what is the controversy to be resolved and/or the decision or evaluation that needs to be made.

--   Read the questions developed for the case. These are either at the end of the case or in the syllabus. Then go back through the case and develop the information and analysis needed to respond to the questions. These questions are to help guide your analyses of the situations.

--   After answering the questions, ask yourself, "Have I resolved the issue(s) in this case?" In many cases, the question answers are not an end themselves, but merely the means to help give you insights into resolving the case issues. Your own capabilities can then be used to come to some meaningful conclusions or recommendations.

--   Make notes that would be helpful to you if you are called upon to start class. In many instances, it is effective to begin a class presentation by giving a brief synopsis of the case situation and issues (but not a lengthy rehash of case facts) before linking your question answers to your conclusions about the case issues.

<u>Session 1</u>, **August 25** - *Course Introduction.*

Learning objectives for this session:
- **Introduce the basic input-transformation-output model of operations.**
- **Understand the role of operations management in business.**

1. Read *A Taxonomy of Process Types Note* (**CP**).

2. Read *Some Thoughts on Learning by the Case Method* (**CP**).

<u>Session 2</u>, **September 1** - *Comparison of Job Shops and Flow Shops.*

Learning objectives for this session:
- **Introduce the spectrum of process types.**
- **Understand the general characteristics of job shops and flow shops.**
- **Introduce the trade-offs between efficiency and flexibility.**
- **Introduce the notions of economies of scope and economies of scale.**

1. Read *Process Fundamentals* and *How to Prepare a Case* (**CP**).

2. Read <u>Plant Tour A</u>, *Androscoggin Paper Mill,* pp. 17-41 of (**CP**). As you read, focus on the general characteristics of flow shops that were given in the *Taxonomy of Process Types* note.

    a. How much raw material, WIP, and finished goods inventory does the mill carry? Why?

    b. Why did the mill integrate backward? Why not further forward?

    c. Why is machine #1 given a wider product line (48 different bond and offset products) than machine #4?

3. Read <u>Plant Tour B</u>, *Norcen Industries*, pp. 42-67 of (**CP**).

    a. How is production planned? What are the roles of Joe Gehret, Dan Steinbacher, and the machinists in scheduling production?

    b. Why doesn't Norcen integrate, either backward or forward, more fully?

    c. The CNC machines are faster and more accurate than manual labor. Should these machines be used for longer runs or shorter runs? (Consider Androscoggin's logic concerning machine #1 and see if it applies here).

4. Read *Conventional Worker Shifts Get Redefined* (**CP**).

<u>Session 3</u>, **September 8** - *High Volume Discrete Manufacture.*

Learning objectives for this session:
- **Understand the concepts behind designing a production line to balance workloads, cycle time implications, and worker considerations.**

    Prepare the questions in *Assembly Line Design* (**CP**).

<u>Session 4</u>, **September 15** - *Job Shop Scheduling in a Service System.*

Learning objectives for this session:
- **Master the key elements of scheduling both work and workers in job shops. These include sequencing, schedule evaluation, and personnel scheduling.**
- **Appreciate the impact of variety and variability on scheduling operations.**

1. Read <u>Chapter 10</u>, *Shop Floor Control*, pp. 343-348 (**CP**).

2. Prepare *Aerospace Maintenance, Inc*. (**CP**).

    a. Calculate the workload on each of the four repair stations (in hours per day) imposed by a daily receipt of one engine of each type (A, B, and C). Is the current capacity of the shop sufficient to service the orders that Jack Quirk has taken?

b. Develop a schedule for June 27 and 28 that would have increased profits.

c. Then, think about worker scheduling, in 8-hour shifts, allowing overtime and/or undertime.

d. What is the key to profitable operations for Aerospace?
WARNING: This assignment can be an unbounded time sink. I suggest that you spend no more than 3 hours on it. If you still have time, give some thought to the scheduling of workers for 8-hour shifts.

3. Review *Conventional Worker Shifts Get Redefined*, **Toledo Blade (CP).**

Session 5, **September 22** - *Project Management and Aggregate Planning.*

Learning objectives for this session:
- **Become familiar with basic project management concepts: work breakdown structure, task definition, precedence, network representation, and time and cost management of projects.**
- **Apply capacity concepts to the task of aggregate production planning.**
- **Distinguish two extreme, generic, aggregate planning approaches (level production and chase demand) as well as the tactics that support them (hire or fire, overtime or undertime, subcontracting, and inventory manipulation).**

1. Read *Project Management*, pp. 358-368 **(CP).**

2. Prepare *Reynolds Construction Company* **(CP)**. Questions are in the case.

3. Read *Aggregate Capacity Planning Note*, pp. 1-9 **(CP).**

4. Prepare *Aggregate Planning at Organica* **(CP).**

a. Identify the economic tradeoffs that must be considered in developing a 12-month workforce and production plan.

b. Manually develop a low-cost workforce and production plan. (Hint: Manually evaluate the extreme strategies, "level" and "chase", and try to improve upon the better of these two.)

Session 6, **September 29** - *Economic Order Quantities and Inventory Control.*

Learning objectives for this session:
- **Become familiar with the basic inventory concepts: inventory costs, dependent versus independent demands, and economic order quantity.**
- **Understand some of the many useful extensions to the basic model.**

1. Read *Economic Inventory Control Note* **(CP)**.

2. Read "*Using Mathematics to Solve Some Problems in Industry*", **INFORMS Transactions on Education,** pp. 1-6 (January 2005).

3. Prepare *Gentle Electric* **(CP). All requisitions** are subject to both clerical and expediting costs.

a. Assume that the original transformer price is $500 per unit. Were 25 units per requisition the most economical way to order?

b. When Gentle Electric was offered a volume discount, which costs were affected? What should their order quantity be? (To clarify the discount structure, for example, 210 units would cost $50,000 + $49,000 + $4,750 = $103,750 (not 210 x $475).

c. How many should they order from the West Coast firm?

Hint: For **b** and **c**, there are discontinuities in the total cost function. You need to develop a **total cost** formula for each smooth segment of the total cost curve.

Session 7, **October 6** - *Guest Lecturer on New Product Development/Quality Process Improvement.*

Learning objectives for this session:
- **Understand the role of marketing in the new product development process.**
- **Understand the interface between marketing and engineering.**

• **Acquire new tools and techniques for understanding the wants, needs, and desires of customers.**

1. Read *Bagel Sales Double at Host Marriott Using Quality Function Deployment* **(CP).**

2. Glenn H. Mazur, President, Japan Business Consultants, Ltd. and Executive Director of the QFD Institute, Ann Arbor. For more information check: www.mazur.net

3. Optional: Read "The Limits of Mass Customization" **(CP)**.

Session 8, **October 13** - **Midterm Exam.**

Session 9, **October 20** - *Just-in-Time Production Systems and Materials Management*.

Learning objectives for this session:
- **Understand the theoretical workings of kanban systems for material management, including the basic concepts of *kanban, kaizen, jikoda,* and *heijunka*.**
- **Understand how the Toyota Production System works in practice, especially the coordination of material flows with information flows within an organization and across organizational lines.**
- **Understand the differences in philosophy and practice between just-in-time manufacturing systems and other systems.**
- **Understand Toyota's design of a system for materials flow: purchasing, materials handling, tracking and accounting, vendor qualification, and distribution.**

Prepare *Toyota Motor Manufacturing, U.S.A., Inc*. **(CP).**

a. How frequent are andon pulls occurring in the final assembly area? What run ratio would you consider to be satisfactory?

b. How should Doug Friesen approach the seat problem? What are his options for action? Do the potential actions address the root cause of the seat problem?

c. Is the existing protocol for handling defective seat assemblies in keeping with the Toyota Production System philosophy?

Session 10, **October 27** - *Seru*: The Organizational Extension of JIT*; Linear Programming I: A Resource Allocation Tool for Management - Introduction to Concepts.*

Learning objectives for this session:
- **Learn about a new Japanese organizational and production system, *seru*, and why it is better than conventional production systems for electronics assembly.**
- **Identify situations suitable for MRP and JIT.**
- **Understand the usefulness of constrained optimization in solving resource-constrained problems.**
- **Understand the concepts of optimizing an objective function subject to constraints.**

1. Read *"An Implementation Framework for Seru Production,"* International Transactions in Operational Research (January 2014).
Download and print it from http://onlinelibrary.wiley.com/doi/10.1111/itor.12014/full .

2. Read "*Seru*: *The Organizational Extension of JIT for a Super-Talent Factory,"* International Journal of Strategic Decision Sciences (March 2012).

3. Read "*The Evolution of Seru Production Systems Throughout Canon*," Operations Management Education Review (December 2008).

4. Read *"Radical New Way to Build Vehicles,"* Ward's Auto World (September 2011).

5. Read *Linear Programming: A Brief Overview* (**CP**).

6. Read *Note on Linear Programming*, pp. 1-5 (**CP**).

7. Prepare Questions 1-4 of *Lindholm Snowmobile Company* (**CP**).

<u>Session 11</u>, **November 3** - *Linear Programming II: How to Use LP Software.*

Learning objectives for this session:
- **Learn how to use an LP package to solve a linear optimization problem.**
- **Learn how to formulate various types of problems as a linear program.**
- **Understand the sensitivity of an optimal solution to potential changes in various system parameters, resources, and constraints.**

1. Formulate the following problems related to *Lindholm Snowmobile* and solve using Excel's Solver. Read "*Using Solver for Complex Problems*" (pp. 10.1-10.8 and 10.18-10.29) (**CP**) and "*Note on the Use of Solver in Excel*" (**CP**) to see how to run the program and enter the data.
   (If you have questions on how to run Excel Solver, please see **Duc Vu**, office: JSOM 14.211; email: Duc.Vu@utdallas.edu.)

   a. Formulate Lindholm Snowmobile's product mix decision as a linear programming problem. Determine the optimal mix. (Use 0.714 as the decimal equivalent of 5/7.)

   b. Find the best product mix for Lindholm, if it had 33,334 units of Model S equivalent engine capacity. How much is that one additional unit of engine production capacity worth to Lindholm?

   c. How many units of engine capacity (still expressed in Model S equivalent units) can be added before there is a change in the value of an additional unit?

   d. Assume that the engine production department can be put on overtime. Production efficiencies do not change, and up to 20,000 Model S equivalent units of capacity would be added by this overtime shift. The direct labor overtime premium is 50%, and engine department fixed overhead will increase by $300,000 per month; variable overhead will remain the same per engine. Should Lindholm add this overtime shift?

   e. The sales manager feels that it is important that the number of Model S snowmobiles produced each month be at least four times the number of Model V snowmobiles. With this added constraint (and department capacities as in the original problem), what is the optimal product mix?

2. Read *Note on Linear Programming*, pp. 6-14 (**CP**).

3. Formulate and solve (using Excel's Solver) the *3 Extra LP Problems* (**CP**).

4. Read *Aggregate Capacity Planning Note*, pp. 10-14 (**CP**).

5. Formulate (don't solve) *Organica's* aggregate planning problem as a linear program.

<u>Session 12</u>, **November 10** - *Linear Programming: Formulation and Solution Exercises/Problems in Evaluating and Implementing New Technology; Flexible Automation and Technological Change.*

Learning objectives for this session:
- **Learn more about the power of modeling and solving a problem as a linear program.**
- **Understand the significant advantages available from flexible automation and the value of flexibility.**
- **Learn about the state-of-the-art of flexible manufacturing.**
- **Understand the difficulties in effectively using such highly automated, integrated systems.**

1. Read *"Using Mathematics to Solve Some Problems in Industry"*, **INFORMS Transactions on Education,** pp. 6-10 (January 2005).

2. Read *Red Brand Canners* (**CP**). Formulate Red Brand's product mix decision as an LP problem. Use *contribution* as the objective function, and express decision variables in terms of *thousands of pounds* of tomatoes (rather than cases of product). Carry two decimal places in fraction approximations. Solve Questions a, b, and c using Excel's Solver.

   a. Assuming that only the contracted crops totaling 3 million pounds are available, and assuming <u>zero</u> cost for these tomatoes in your LP formulation, what is the contribution from this mix, <u>after</u> accounting for the cost of the tomatoes?

   b. Repeat Part a, only include tomato cost in your objective function coefficients at 18¢ per pound. Why is the optimal product mix different than it was in Part a? Why is the contribution different than the net-of-tomato-cost contribution in Part a?

    c. Now assume that up to 80,000 pounds of additional Grade A tomatoes can be purchased for 25 ½¢ per pound. How does this change things? How many, if any, of these additional tomatoes should be purchased?

3. Read:

- *"Euro Fabricators Use Hands-Off Approach,"* **Modern Applications News** (August 2004). (**CP**).
- Martin Piszczalski, "*Strategies for Spending Millions*," **Managing Automation** (August 1987) (**CP**).

4. Automation videos are shown. We discuss the current state of the art with respect to robotics, automation, and flexible manufacturing systems.

Session 13, **November 17** - *Flexible Manufacturing Capacity Expansion Decisions, Implementation Plans, Technological Adoption Issues, and Economic Justification.*

Learning objectives for this session:
- **Understand the capacity implications of new technology acquisition decisions over time.**
- **Develop an understanding of the cost calculations and capacity analyses for various alternatives.**

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1. Prepare Baker Precision Instruments, Inc.

    a. What should be done in the short term? How would you deal with the immediate capacity crunch? How would you phase in any new FMSs or AMLs?

    b. How much capacity should be acquired and when? Develop a capacity expansion plan that takes into account demand projections from 1996 through 1999 so as to achieve the objectives of low cost, fast, reliable delivery, and good quality.

    c. What kind of capacity would you recommend Baker buy? In the long run, what are the pros and cons of both FMS types? Take into account both qualitative and quantitative factors.

2. Final Exam Review (LP).

Session 14, **December 1** – **Exam 2.**