Pedagogical Goals

- Integrate a quantitative problem that requires OR/MS/IE methodologies with ethical decision making
- Currently developing assessment methodology for OR/MS/IE ethical decision making
- Improve aspects of moral reasoning including judgment, awareness, and motivation in the context of the types of dilemmas faced in the field
- Expose students to realistic complex decision environment
- Require students to sift through a large amount of data to determine relevant information for modeling the problem

The Groundhog’s New Clothes

- Topic: Aggregate Production Planning (APP)
- Ethical issues
  - Responsible downsizing
  - Responsibility for suppliers actions
  - Personal versus professional responsibilities
- Focus is on linking quantitative planning models with ethical decision making

Current State of Ethics Instruction

- Introduction of ethical issues is required for accreditation
- Popular methods of incorporating ethics into curriculum
  - Modules in existing methods courses
  - Business law-based general ethics course
  - Humanities-based general ethics course
  - Dedicated engineering ethics course

Reasons to Teach Ethics “In-House”

- Focus on discipline-specific decision environment
- Exposes students to the types of dilemmas that arise in their field
- Emphasizes practical ethics, allowing students to recognize ethical issues and apply decision-making methodologies
- Share personal working experiences
- Ethics can be viewed as unimportant if delegated to another department
- Students are unsure of professional ethical practice
The Groundhog’s New Clothes

- Topic: Aggregate Production Planning (APP)
- Ethical issues
  - Responsible downsizing
  - Responsibility for suppliers actions
  - Personal versus professional responsibilities
- Focus is on linking quantitative planning models with ethical decision making

Problem Setting

- Beauti-Phil Apparel
  - Located in Punxsutawney, PA
  - Manufacturer of custom t-shirts and golf shirts
  - Small, loyal workforce of 80 factory employees
  - Owners have strong personal relationships with employees
  - Recently lost lucrative Groundhog Day account, reducing demand forecast
    - Firm is overcapacitated with regards to labor

Beauti-Phil Products

- Firm must decide how to maintain profitability with drop in demand
- Other information
  - New raw material supplier has offered a proposal that would reduce materials cost
    - This potential supplier has been accused of environmentally-unfriendly practices in a trade magazine
  - Additional case scenario includes child labor accusations
  - Beauti-Phil is considering market expansion into surrounding communities
  - Owners have claimed in the past that they “would not fire a good worker”

Additional Information

- Traditional APP data
  - Hiring costs
  - Firing costs
  - Production costs (material, labor, and overhead)
  - Subcontracting costs
  - Six month demand forecast for each good
  - Monthly production days
  - Average worker productivity
  - Production yield rate
- Irrelevant data
  - Quantity discount pricing policy
  - Production facility leasing information
  - Fixed overhead costs

Deliverables

- Prepare a six-month aggregate production plan
- Linear (integer) programming
- Heuristics (trial and error or “pure” strategies)
- Draft a short (2-3pg) memorandum to owners
  - Identify stakeholders in decisions
  - Propose several feasible alternatives
  - Determine how each stakeholder would be affected by each action
  - Identify most important factors in making decision
  - Provide recommendation and explain why you reject the other viable alternatives
Modeling

- Sample integer program

\[
\begin{align*}
& \min \sum_{i=1}^{n} c_i x_i + \sum_{i=1}^{n} \sum_{j=1}^{m} a_{ij} y_{ij} + \sum_{i=1}^{n} \sum_{j=1}^{m} b_{ij} z_{ij} + \sum_{i=1}^{n} \sum_{j=1}^{m} d_{ij} t_{ij} \\
& \text{subject to:} \\
& \sum_{i=1}^{n} x_i + \sum_{i=1}^{n} \sum_{j=1}^{m} y_{ij} + \sum_{i=1}^{n} \sum_{j=1}^{m} z_{ij} + \sum_{i=1}^{n} \sum_{j=1}^{m} t_{ij} = \text{supply} \\
& \sum_{i=1}^{n} a_{ij} y_{ij} + \sum_{i=1}^{n} b_{ij} z_{ij} + \sum_{i=1}^{n} d_{ij} t_{ij} = \text{demand} \\
& y_{ij}, z_{ij}, t_{ij} \geq 0
\end{align*}
\]

Possible Alternatives

- Variety of recommendations
  - Constant workforce and new supplier – 11 groups
  - Adjusted workforce and current supplier – 4 groups
  - Reduced hours and current supplier – 5 groups
  - Adjusted workforce and new supplier – 4 groups
  - Reduced hours and new supplier – 1 group
- No clear consensus among the groups
- Case dilemmas do indeed have several ethically-viable alternatives with different quantitative solutions

Discussion Results

- Students emphasized that managers should strive to be consistent in their actions
- Discussion of Gap as example of doing business with a controversial supplier
  - Child labor
  - Cultural differences
  - Home market perception
- Alternatives to layoffs
  - Shifting factory workers to sales positions to increase demand
  - Challenging workers to engineer their positions to reduce costs
  - Offering buyout packages

Discussion Results (continued)

- Which workers should be laid off?
  - Lowest productivity workers
  - Older workers (because they likely make more)
  - Workers who do not support families
  - Most recently hired workers
- Union considerations
- Wrongful termination lawsuits
  - Key is to be as objective as possible—limit subjectivity in the decision

Suggested Use

- Undergraduate or graduate courses
  - IE school manufacturing systems
  - IE school optimization
  - Business school operations management
  - Business school production planning and inventory control
- Designed as group assignment, but could be given as individual assignment
- Ideally accompanied by class discussions

Teaching Notes

- Additional discussion questions
  - What obligation does a firm have to a workforce that has provided loyal service for a long time?
  - What does it mean for a firm to be a good corporate citizen?
  - How does a manager place limits on personal relationships when they conflict with professional interests?
  - When are layoffs justified? Are there any viable alternatives to layoffs?
  - Suppose you determine that layoffs are necessary. How do you determine which workers to lay off?
  - Ethical theories background material
  - No ethics expertise is needed for instructors!
  - Additional case scenario
Current Use

- Distributed to faculty at UC Berkeley, Northwestern, U of Pittsburgh, Stanford, U of Florida, Virginia Tech, MIT, Lehigh, U of Maryland, Duquesne, Penn State, Notre Dame, and NC State
- Taught in three sections of ISyE 3104 Manufacturing and Warehousing Systems (~120 students)
  - Introductory production planning lectures
  - Case completed in groups of ~4 students with report submitted in two weeks
  - One period of class discussion
- Planned use in ISyE 4231 Engineering Optimization and ISyE 4331 Honors Optimization (~90 students)

Student Evaluations

- 1 2 3 4 5
- Count

Likert Scale

- This case provided effective exposure to a complex decision-making environment
- I feel more prepared to make decisions in a situation with multiple reasonable alternatives
- This case increased my awareness of the types of ethical dilemmas faced by IE’s
- This case gave me practice in modeling a complicated production plan
- This case was a valuable learning experience for me
- Overall, I enjoyed working on this case

Student Comments

- “[The case] included many aspects of industrial engineering practice. I also like the ethical aspect. This side is not always included in our education and case studies.”
- “I liked that it was very realistic and that we got to make a decision based on what we thought was best—not based on trying to get ‘the right answer.’”
- “I liked the environmental discussion. We never discuss ethics in most IE classes, and it was good practice for the future.”

Student Comments (continued)

- “I liked the fact that the case shows how close the relationship between business and community can be.”
- “I enjoyed the fact that the ethical dilemma was integrated as part of the case study rather than the project being an exercise in linear programming. Even simplified, I found it to be more consistent with real world cases than other problems we work on.”
- “I liked that it helped me work through a problem with many constraints, so that I feel confident now that I can solve all kinds of problems. It was a pain, but it helped.”

Summary

- Moral education research results
  - Ethics instruction should be integrated throughout the curriculum (Rest and Narvaez 1994)
  - Dilemma discussions rather than lectures (Schaefli 1985)
- Case outcomes
  - Integrates quantitative OR/MS/IE problem with ethical decision making
  - Improves moral reasoning by increasing awareness of ethical issues and moral courage
  - Demonstrates students’ ability to model a complicated optimization problem and use it in scenario analysis

Thank You for Your Consideration!