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Details and Description of Industrial Engineering

Paul Savory
University of Nebraska at Lincoln, psavory2@gmail.com

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DETAILS AND DESCRIPTION OF INDUSTRIAL ENGINEERING

Paul Savory, Ph.D.

Department of Industrial and Management Systems Engineering
University of Nebraska - Lincoln
Lincoln, Nebraska 68588-0518

Note: this is not original work. Much of this material is a conglomeration of descriptions and examples obtained from the internet.

What exactly is Industrial Engineering (IE)?

Do you like solving problems? Are you interested in how things work? Do you like working with people? Are you an organizer? Do you like working on a team? Does using computers to solve practical problems interest you? Would you like to study a blend of business and technical subjects? Are you interested in the way individual parts of a system work together? Are you looking for a challenge? *If you answered yes, then keep reading, Industrial Engineering (IE) might be the perfect major for you!*

Other engineering disciplines apply skills to very specific areas: Electrical Engineers are concerned with electrical systems and designing circuits, Mechanical Engineers are concerned with mechanical systems and building devices, Chemical Engineers are concerned with chemical systems and explore chemical processes, and Civil Engineers are concerned with physical systems and build structures. *So what do Industrial Engineers build?* The short answer is that we design processes and systems that improve quality and productivity. Using knowledge of engineering, mathematics, business administration, and management, we focus on the *way* products and services are made and performed. Though a combination of technical abilities, people skills, and business savvy, we analyze, design, build, and manage systems. Industrial Engineers integrate combinations of people, information, materials, and equipment that produce innovative and efficient organizations. In addition to manufacturing, Industrial Engineers work and consult in every industry, including hospitals, communications, e-commerce, entertainment, government, finance, food, pharmaceuticals, semiconductors, sports, insurance, sales, accounting, banking, travel, and transportation.

Industrial Engineers figure out how to do things better. They make significant contributions to employers by saving money while making the workplace better for fellow workers. Industrial Engineering is the branch of Engineering most closely related to human resources in that we apply social skills to work with all types of employees, from engineers to salespeople to top management. One of the main focuses of an Industrial Engineer is to improve the working environments of people – not to change the worker, but to change the workplace. We work to make others work better. Writing and presentation skills are very important for us. We measure employee aptitude and motivation to encourage communication, morale, and leadership. We study Japanese management techniques such as kaizen, just-in-time delivery, Taguchi methods, and kanban.

With its diversity, Industrial Engineers appeals to a wide cross section of employers and you will have the opportunity to work in lots of different types of businesses. The most distinctive aspect of industrial engineering is the flexibility that it offers. Whether it's reducing passenger waiting time for a roller coaster ride, scheduling the use of an operating room, developing a plan for distributing a product worldwide, or manufacturing superior automobiles – *it's all in a days work for an industrial engineer.*

As an Industrial Engineer, you will:

- Earn an excellent salary
- Work with people – to make things better, faster, safer, and more rewarding
- Help a company save money and stay competitive
- Reap personal and professional satisfaction year after year
- Work with all levels of a business or organization

What personality characteristics do Industrial Engineers have?

Common characteristics of an Industrial Engineering include:

- Inquisitive mind
- Negotiation skills
- Listening skills
- Creative problem solving
- Diplomacy
- Patience
- Ability to adapt to many environments and interact with a diverse group of individuals
- Good common sense
- Continuous desire to learn
- Leadership skills
- Resourcefulness
- Desire for organization and efficiency
- Good math skills
- Strong time management skills
- Mechanical aptitude
- Excellent communication/salesmanship
- Quantitative skills
- Technical competency
- Continuous drive for improvement
- Passion for improvement

What types of projects do Industrial Engineers work on?

The following are examples of the wide diversity of projects that an Industrial Engineer might work on:

- Reducing waiting times for rides at an amusement park
- Developing the conceptual layout of a dockyard and ship repair maintenance facility
- Designing the admissions procedure at a hospital
- Planning the flow of materials to the assembly line in an automobile factory
- Discovering a new way to assemble a product that will prevent worker injury
- Managing and tracking progress on the installation of a new baggage tracking system for an airline
- Determining the reliability and maintenance needs for the air conditioning system of a hospital
- Determining what are the most cost-effective precautions to reduce the occurrence and environmental impact of oil spills
- Optimizing how can a dress manufacturer lay out its patterns to minimize wasted material
- Planning how often should the sales force of a frozen yogurt company call on its customers
- Deciding how many elevators should be installed in a new office building to minimize passenger waiting time
- Developing a supplier quality program
- Assigning and scheduling doctors, nurses, and facilities in a hospital
- Exploring what's the most efficient method for routing a long-distance telephone call
- Determine the best locations for building new fire and police stations
- Planning how long should the warranty on an automobile or appliance run, what should it cover, and what will it cost the manufacturer
- Adding a conveyor system to automate material handing in an electronics manufacturing facility
- Creating an information system for tracking hazardous materials
- Integrating systems for satellite tracking of shipments and trucks
- Exploring the impact of adding robots to a manufacturing line
- Creating software for efficient routing of package delivery trucks
- Representing manufacturing and purchasing issues on a team designing a new product
- Developing a procedure for how workers will be evaluated
- Designing vehicles for the disabled
- Converting a major production line to use a just-in-time or kanban inventory system
- Developing and launching a material handling system for a new automobile factory
- Representing a company in the design and construction of a new manufacturing plant
- Developing prototype units for the cellular phone car adapter market
- Working on a design project to make a medical device to treat sleep apnea
- Improving the quality of cellular phones
- Designing and testing the web page interface for a company
- Integrating computer voice systems for order-pickers in a warehouse

What types of jobs do Industrial Engineers have?

Industrial Engineers use their problem-solving techniques in almost every organization you can imagine. There are Industrial Engineers working in manufacturing, banks, hospitals, government organizations, transportation, construction, processing, social services, electronics, facility design, safety, and warehousing. Because Industrial Engineers are needed in such a large spectrum of fields, there is a variance in the type of working conditions you could expect. As an Industrial Engineer, you could be involved in such activities as: long-range planning, new facility design, robotics development, installation of manufacturing systems, improvement of work flow, design of a management information system, statistical analysis, optimization studies, economic decision-making, job hazard analysis, project management, manufacturing processes improvement, inventory control, or quality control.

Consider the following job descriptions:

- As an **industrial engineer** for United Airlines, you might use computer simulation to decide on the best way for passengers to board airplanes

- As an **ergonomist** for John Deere, to reduce the risk of repetitive stress injuries, you may assess and change the tools that workers use or help redesign the tractor to safer and easier to use by the farmer

- As a **quality manager** for Ford Motors, you may be responsible for supervising supplier quality by using acceptance sampling plans to monitor incoming shipments of materials

- As a **team manager** for Hershey Foods, you may be in charge of inventory management, quality control, budgeting, and employee development, or may work to improve the product packaging to minimize candy breakage on it journey to the store

- As a **management consultant** at Creighton University Hospital, you may help doctors and nurses make the best use of their time in treating patients. You may also design procedures for optimum use of medical facilities to help bring down the cost of healthcare and make the hospital a safer and more pleasant place to be for the patients and their families.

- As an **operations analyst** for American Airlines, you may design a bar coding system for identifying and transporting passenger luggage to ensure that it does not get lost

- As a **quality engineer** for Omaha Public Power District (OPPD), you may improve customer satisfaction by designing a process to schedule service calls around the availability of the customer

- As an **inventory controller** for Hallmark Cards, you may be responsible for forecasting sales of cards and using those results to monitor card inventory levels and schedule card production

- As a **project engineering** for Walt Disney Company, you may be involved in developing pickup and dropoff schedules for trains and shuttle busses

- As an **industrial engineering** for the US Postal Service, you may determine staffing requirements, create efficient mail flows, cost justify new equipment, and methods improvement.

Since Industrial Engineers focus on integrating people, machines, and information to effectively, efficiently, and safely produce goods and services, the employment possibilities are endless. Common titles that Industrial Engineer can have in an organization include:

- Industrial Engineer
- Quality Engineer
- Manufacturing Manager
- Project Manager
- Inventory Controller
- Systems Consultant
- Process Engineer
- Manufacturing Engineer
- Systems Analyst
- Manufacturing Consultant
- Production Supervisor
- Consultant
- Technical Sales
- Quality Control Supervisor

Where do Industrial Engineers work once they graduate?

As an industrial engineer, you will have the opportunity to work in a variety of businesses and organizations. A small sampling of the companies that hire Industrial Engineers include:

Airborne Express	Allen Bradley	Amazon.com
American Airlines	American Greetings Corp.	Amway Corp.
Anheuser-Busch Co.	Bausch & Lomb	Blockbuster Video
Boeing	Bristol-Myers Squibb Co	Campbell Soup Co
Cessna Aircraft Co	Chick-Fil-A	Chrysler Corporation
Clairol Inc.	Coca-Cola	Deere & Company
Duracell	E & J Gallo Winery	Eastman Kodak
Energizer	FedEx	Frito-Lay
Gateway Computer	General Motors	Hallmark Cards
Hewlett-Packard	Intel	Kodak
Microsoft	Mercedes-Benz	Motorola
Nestle USA	Nordstrom	Reebok International
Sabre Decision Technologies	Sears, Roebuck and Co	Sizzler Steakhouse

Sprint	Square D Company	Taco Bell
Texas Instruments	The Gap	The Home Depot
Sherwin-Williams	United Airlines	US Postal Service
Wal-Mart Stores	Westinghouse	Whirlpool

Nebraska-based companies that hire Industrial Engineers include:

United Parcel Services	Hormel Food	Peter Kiewit
Avaya	Union Pacific Railroad	IBP
Goodyear	Centurion	Lincoln Composites
Hewlett Packard	First Data Resources	3M Corporation
Allegiant Health	Molex	OPPD
Square D	Becton Dickinson	ConAgra

We encourage you to visit one of the job databases on the internet (www.monster.com or www.hotjobs.com) and do a search for "Industrial Engineer". We guarantee that you will be excited by all the employment prospects that are available.

How much can Industrial Engineers earn?

Industrial engineering is a profession that offers you great variety and tremendous earning power. Recent graduates from UNL's Industrial Engineering program have had starting salaries in the range of $45,000 to $52,000. Nationally, according to a 1999 salary survey by the National Association of Colleges and Employers, Bachelor's degree candidates in Industrial Engineering received starting offers averaging about $43,100 a year and master's degree candidates had offers at $49,900. IE Solutions magazine reported in 1999 that the average entry-level salary for Industrial Engineers is approximately $42,000 a year.

Employment of Industrial Engineers is expected to continue to grow in the coming years, reflecting industrial growth, more complex business operations, and greater use of automation in factories and offices.

I have never heard of IE, is it a new area?

Yes and No. At other universities, Industrial Engineering departments began to form following World War II. At UNL, the Department of Industrial and Management System Engineering was founded in 1970 (before then, our courses and materials were part of Mechanical Engineering). Even though Industrial Engineering is relatively new in comparison to other engineering discipline, it is built on a strong foundation of traditions and skills that have been studied for over a hundred years.

Industrial Engineering can trace many of its roots back to Frederick Taylor's work in developing his theory of scientific management. In the early 1900s, as the world, and in particular the United States, was moving from an agrarian economy to a production economy, Taylor's initial studies into the *science of work* were attempts at solving some of the same problems that face industrial engineers. Central to the discipline of industrial engineering are two themes: the

interfaces among people and machines within systems and the analysis of systems leading to improved performance. These issues motivated Taylor and they motivate us as Industrial Engineers today.

How do Industrial Engineers benefit society and business ?

Industrial engineering provides a systematic approach to streamline and improve productivity and efficiency. Benefits that can be linked directly to the work of industrial engineers include:

- Leaner, more efficient, and more profitable business practices while increasing customer service and quality.
- Improved efficiency. This improves competitiveness, profitability, and reduces resource requirements.
- The idea of setting labor or time standards. The original production lines in the 1920s were successful because of Industrial Engineers.
- Good organization and improving productivity – these improvements eliminate or reduce some of the frustrations of life and are essential to the long-term health of business.
- Increased ability to do more with less.
- Making work safer, faster, easier, and more rewarding.
- Providing a method by which businesses can analyze their processes and try to make improvements to them. It is focused on optimization - doing more with less - and helps to reduce waste in society.
- Reduce cycle time and increase throughput thus helping more people get their product quicker.
- Assistance in guiding society and business to care more for their workforce while improving the bottom-line.
- Showing ways to improve the working environment and improve efficiencies
- Making the world safer through better designed and easier to use products.
- Reducing costs associated with new technologies, thus allowing more of the population to better their lives by being able to afford technological advances.

What classes will I take as an industrial engineering student?

On average, it takes four years to earn a bachelor's degree in industrial engineering. Typically, the first two years are spent studying basic sciences (mathematics, physics, and chemistry), introductory engineering, the humanities, social sciences, and English. During the last two years, most courses will concentrate in industrial engineering. Industrial Engineers have broad training in many areas including people-oriented techniques, design-oriented techniques, basic engineering principles, applied math, computer techniques, communication skills, psychology, humanities, and the arts.

The Industrial Engineer curriculum prepares graduates to pursue registration as a Professional Engineer. In addition, the broad learning experience allows you the flexibility to continue toward a Master's degree in Industrial Engineering or for an advanced degree law, business, medicine, or psychology.

Courses in the Industrial Engineering undergraduate curriculum cover five main focus areas:

- *Production* – improving the operation of a system. Key course topics you will learn: forecasting, inventory control, quality control, facility layout, material handling, economic analysis, production planning and control, quality control, and facilities design.

- *Management* – how to organize people and projects. Key course topics you will learn: defining project teams, evaluating employees, controlling budgets, control costs, project planning, assigning jobs to workers.

- *Ergonomics* – how people and machines interact. Physical ergonomics view the human as a biomechanical device while cognitive ergonomics examines the cognitive aspects of humans. Key course topics you will learn: design for human use, engineering psychology, anthropometry, workplace design, work environment (safety), physiological limitations, control system interaction, computer interaction.

- *Manufacturing Processes and Systems* – how parts are made and how manufacturing systems communicate. Manufacturing process deals directly with materials forming, cutting, shaping, planning. Manufacturing systems focus on the integration of manufacturing process, usually through computer control and communications. Key course topics you will learn: process planning, computer-aided design, robotics, scheduling, metal cutting theory, metrology, programmable logic control, numerical control

- *Operations Research* – methods for the general analysis and design of systems. Key course topics you will learn: optimization, linear programming, queuing theory, dynamic programming, network analysis, stochastic modeling, simulation, nonlinear programming

What are examples of problems I will learn how to solve?

The following are examples of problems that you will be able to tackle once you graduate from Industrial Engineering. By no means is the list exhaustive, it simply is to provide you a picture of the diverse challenges that an Industrial Engineer faces:

HUMAN-MACHINE INTERACTIONS
A large bank is redesigning its ATM facilities. Their interest is to offer customers more services at the machine, but they want to do this in a way that does not increase (and hopefully reduces) customer inconvenience and confusion that typically results from poor instructions, illegible message displays, etc. They want you to create a single new design that is suitable for all of their branch facilities. Any ideas? How would you measure whether or not one design is superior to another?

PLANNING

The Housing Office at University of Nebraska has to deal with a big problem every fall; how to make dormitory assignments so as to leave everybody reasonably happy. (Of course, it may not be possible for everybody to be actually "happy" with their roommate assignment so Housing's true aim would probably be to at least minimize the amount of misery created overall with the assignments.) Here's the situation – suppose that for the fall semester a total of 1700 freshmen are planning to live on campus and in a dorm. Each student has, as part of their enrollment information, submitted a "wish list" regarding their preferences in terms of a roommate. These include such things as non-smoking, serious study habits, from Kansas, not from Kansas, likes jazz, talkative, no pet snakes, etc. Some of these attributes may have higher priorities than others so Housing may weigh them in some way. In any event, what Housing would like to do is find a pairing of individuals that, in some sense, maximizes total *acceptability* and for which there is enough dorm space. For example, if two rooms are available for four students, but one student is absolutely unacceptable to the other three (under any circumstance) then two rooms will simply not suffice. Nonetheless, how do you go about solving this problem? Does it get easier or harder if, rather than pairs, Housing is looking for groups of three (*i.e.*, dorms with 3-person suites)?

ECONOMIC DECISION ANALYSIS

You are considering making a bid to purchase the oil company HuskerOil Inc. Your plan includes paying cash for all of HuskerOil's shares whatever their value. Now, HuskerOil has recently gambled their company by basing everything on a single exploration project which is being conducted. The value of HuskerOil, based upon the outcome of this project could be as much as $100 million (the exploration project is a success) or as little as $0 (the project is a failure). In fact, HuskerOil knows the value of the company based on the exploration but you do not. However, you calculate that it is equally likely that the value of HuskerOil will fall anywhere between the stated extremes of $0 and $100 million. Because of your management expertise, you will be able to increase the value of HuskerOil by 50% once you purchase them. As long as your offer bid is equal to or exceeds HuskerOil's current value, they will accept. What should you bid?

QUEUEING

A 24-hour grocery chain would like to formalize its policies regarding how many checkout lines to have open at various times. Clearly, at 2:00 a.m. there is little reason to have more than one lane open while on heavy traffic days such as the afternoon prior to Thanksgiving, several lines need to be open in order to reduce customer waiting time and congestion at the checkout area. On the other hand, if too many lines are opened, the additional checkout personnel required to staff the lines have to be taken from other, equally critical, jobs such as stocking and check cashing. Something has to be done for right across the street is a large competitor who is poised to take your business if customers find your checkout process to be too much of an inconvenience. The management of the chain has proclaimed that no new personnel can be hired. However, they have set an objective that the *average waiting time* that a customer experiences for the entire checkout process (waiting in line plus time for checkout itself) is not to exceed 10 minutes. How do you go about designing a strategy that provides the store managers with greater insight into how they might better schedule the opening and closing of their checkout lines? What about opening another express lane? Should the latter be restricted to 10 items or fewer? How about 15 or fewer? Does it make a serious difference? And if the company president makes

a surprise visit at 1:30 p.m. on a Friday and if there are three checkout lines open, what is the probability that he will have to wait in line no longer than 5 minutes?

MANUFACTURING

A manufacturer of natural gas meters has developed an updated version of a gas meter. The company knows that sales will initially be slow for the gas meter due to the resistance of builders and building inspectors to accept change. Though once tested and accepted, sales will greatly increase. Currently, there is not enough cost justification to create a separate assembly line for the new gas meter. Rather, it production will have to be included on the existing gas meter manufacturing line. Your job is to develop the plan for how the new gas meter should be integrated into the existing gas meter assembly line. Your plan needs to be concerned about how the production workers are trained to build the new meter, how quality inspection are to be performed, and what the daily production schedule should be so that new meters meet the forecasted sales.

QUALITY INSPECTION

Quality control is concerned with testing and inspecting a product to confirm that it meets production and customer specifications. Let's consider the production of M&M candies. For the candies, what is quality? That is, what are all the characteristics of quality impacting the production of M&M candies (*e.g.*, condition of package, coating of M&Ms, stamping of "m" on the M&M's, taste, etc.). The goal of a quality inspection plan is to inspect the product to determine whether it meets specifications. Where should inspection occur in the M&M manufacturing process and how should it occur? What types of costs are involved in the inspection plan? What are acceptable level of quality?

BIN PACKING

Your small company uses custom-cut steel reinforcing rod for construction jobs in Nebraska. These rods are purchased from a steel products distributor who is willing to cut the rods for you and to specification. However, the distributor cuts your pieces from stock that is only available in fixed, 60-foot lengths. That is, if you need two lengths of rod, one of 15 and the other of 45 feet, then a single 60-foot piece is cut in the obvious way with nothing left over and all is well. On the other hand, if you need eight, 7-foot pieces, then the 4 feet left over from the 60-foot original is wasted. Of course, some of these excess pieces may be useful later, but you will have to find storage areas for such pieces which, in turn, a cost. Indeed, what is left over may be useless altogether and is simply counted as scrap. Thus, we would like to minimize the number of full, 60 foot units that have to be used in cutting all of the given lengths which means that we may have to be reasonably clever in how we specify the pattern of cuts on each. For example, suppose you need to place an order for 10 pieces of rod having lengths 41, 24, 24, 22, 21, 19, 9, 7,7 and 6 feet respectively. Since the total length of the 10 pieces is 180 feet, it is obvious that the best we could hope to use is three of the 60-foot spans but is this even possible? Naturally, this small numerical example is just a simplified version of what might be a fairly messy problem in general. Indeed, in a real-world setting, you might have an order for hundreds or thousands of pieces to be cut from stock. In addition, the latter might come in varying sizes as well. And yes, your problem might be *multidimensional*. For example, you might seek cutting patterns for 2-dimensional figures from rectangular sheets of aluminum with the aim of minimizing wasted area. You might be operating in a 3-dimensional setting where the requirement is to find a best

packing configuration of irregularly shaped boxes into large unit shipping containers employed by an express mail carrier. Regardless, the underlying theme for any of these packing problems is the same; so too, by the way, is their enormous difficulty.

LOGISTICS
Surplus grain is presently being stockpiled in various warehouses throughout the country (100,000 tons are available in St. Paul; 150,000 tons in Kansas City; 95,000 tons in Denver, etc.). A substantial demand for this grain exists all over Eastern Europe (at least 75,000 tons in Sarajevo; at least 150,000 tons in the Ukraine; 120,000 tons in Poland and so forth). The government has estimated the shipping cost, per ton from each warehouse to each possible demand location. Assuming that we have enough grain to satisfy the total demand, what is the cheapest way to do the shipping? For example, maybe the amount shipped to the Ukraine is satisfied by all of the surplus in St. Paul plus 50,000 tons from Kansas City while from the remaining tonnage in Kansas City, 75,000 is shipped to Sarajevo while 25,000 tons are sent to Poland, etc. Certainly, there are many possibilities; what's the best? Suppose on the other hand that (sadly) we have less grain available than is demanded. That is, some of the locations will have to go without as much grain as they need (at least from that available in the United States). How would you approach the problem now?

ROUTING
A refuse company has a service contract for trash collection in a subdivision in metro-Omaha. This is a relatively large subdivision with approximately 4000 homes; streets are both one- and two-way and trash pickup occurs once weekly (every Tuesday). The company assigns three trucks to the subdivision with all entering at a fixed point, say x and departing, after their work is completed, by exit point y (which is different than x). While no single or even pair of trucks has enough combined capacity to completely service the neighborhood, the capacity of all three will indeed suffice; that is, all three must be used in some configuration. Your objective is to find a fixed route for each vehicle so that the least combined travel distance (considering all trucks) is driven and so that the following restrictions are met: (i) no vehicle capacity is exceeded, and (ii) each street is traversed, adhering to direction if necessary, at least once.

Are Industrial Engineers only concerned with manufacturing?
No. While Industrial Engineer was originally focused on manufacturing, industrial engineers are now involved in the design of systems and processes to produce and deliver goods and services in all types of organization. We work to integrate systems involving people, materials, facilities, finances, equipment, energy, and information. Our objective is to achieve the best possible results in terms of quality, productivity, and safety. The benefit to you is that there is a huge variety of jobs available for you once you graduate.

How is Industrial Engineering like other engineering disciplines?
We are trained in the same basic way as other engineers. We take the same foundation courses in mathematics, physics, chemistry, humanities, and social sciences. We also take some of the basic physical engineering sciences like thermodynamic, circuits, statics, and solids. Like other

engineering disciplines, Industrial Engineering employ mathematical models as a central device for understanding a system.

What makes Industrial Engineer different from the other engineering disciplines?
What sets us apart from other engineering disciplines is our emphasis on both people and technology. Industrial engineering is unique among engineering disciplines in that its focuses on how people interact with a system. This concern for the human element leads to system designs that enhance the quality of life for all people. As a result, many industrial engineers have the leadership qualities necessary to advance in management. Industrial Engineers are often promoted to managerial positions sooner than many other engineers because of their training in leadership and in analyzing systems to improve productivity, quality, and profits.

What are the basic sciences for Industrial Engineering?
Since we deal with the *way* something is done, our tools emphasize *methods* of understanding systems. Fundamentally, Industrial Engineering has no basic physical science like mechanics, chemistry, or electricity. The foundation for our tools and technique are the mathematical sciences – mathematics, statistics, and computer science which provide us with such tools as optimization, stochastic processes, and computer simulation. Our courses therefore use these tools to understand traditional production elements such as economic analysis, production planning, facilities design, materials handling, manufacturing systems and processes, and job analysis.

Don't all engineers use the same math?
All engineers, including Industrial Engineers, take mathematics through calculus and differential equations. Industrial Engineering is different in that it is based on *discrete variable* math, whereas all other engineering is based on *continuous variable* math. We emphasize the use of linear algebra and difference equations, as opposed to the use of differential equations which are so prevalent in other engineering disciplines. This emphasis becomes evident in optimization of production systems in which we are sequencing orders, scheduling batches, determining the number of materials handling units, arranging factory layouts, finding sequences of motions, etc. As, Industrial Engineers, we deal almost exclusively with systems of discrete components.

All Industrial Engineers at UNL take at least two courses in probability and statistics. While other engineering disciplines take only one course in probability and statistics, few have integrated these topics into their advanced coursework. In comparison, many of the courses in our curriculum (production planning, economic risk assessment, and facilities planning, quality control, simulation, and stochastic process) employ statistical models for understanding systems.

How does computing influence Industrial Engineering?
Probably no other aspect of technology has greater impact on us than computing. Like all other engineers, we take computer programming. Specific specialty courses like machine control and simulation expanding the role of computer science principles in our students. Further, most all of our tools are now computer based, with growing recognition that computer-assisted analysis and design of production systems hold new untapped potential. Of special note is how computer simulation involves using specialized computer languages for modeling production systems and analyzing their behavior on the computer.