Engineering Profession (Statistics and Ethics)

Chapter 3

Statistical Overview

- How many people study engineering?
- What are the most common majors?
- What kind of job market is there for engineers?
- How much do engineers earn?

Job Placement Trends

- 1999-2000 was the hottest year for engineering majors to find jobs

- As the number of engineering students declines, employers must “fight” harder to get whatever students they can get their hands on to fill vacant positions. This has led to a very promising job placemen ratio

CIVIL ENGINEERING JORDAN 2015

الهندسة المدنية وتخصصاتها الفرعية					
شعبة الهندسة المدنية	التتخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل	
				مشبع	بطالة
	الهندسة المدنية	27926	11108	●	
	هندسة الطرق والجسور *	2260	1567		●
	إدارة الإنشاء وتكنولوجيا البناء	71	1252		●
	هندسة المساحة والجيوماتكس	1407	968		●
	هندسة مياه وبيئة	1525	758		●

ARCHITECURE ENGINEERING JORDAN 2015

الهندسة المعمارية وتخصصاتها الفرعية					
شعبة الهندسة المعمارية	التخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل	
				مشبع	بطالة
	الهندسة المعمارية	10134	5261	●	
	هندسة تخطيط المدن	170	118		●
	هندسة العمارة وأنظمة البناء	0	50	●	

MECHANICAL ENGINEERING JORDAN 2015

الهندسة الميكانيكية وتخصصاتها الفرعية

شعبة الهندسة الميكانيكية	التتخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل		
				مطلوب	مشبع	بطالة
	الهندسة الميكانيكية	8851	4947		●	
	الهندسة الصناعية	6467	3261		●	
	هندسة التكييف والتبريد	571	1058		●	
	هندسة الأوتوترونكس	738	600			●
	هندسة الإنتاج والآلات	1519	472			●
	هندسة المواد	367	508			●
	القوى الحرارية والآلات الهيدروليكية	3666	535		●	
	هندسة الإطفاء والسلامة	51	240		●	
	هندسة قوى حرارية وطاقة	202	230		●	
	هندسة الطيران	545	264			●
	الهندسة النووية	121	98			●

ELECTRICAL ENGINEERING JORDAN 2015

الهندسة الكهربائية وتخصصاتها الفرعية

شعبة الهندسة الكهربائية	التتخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل		
				مطلوب	مشبع	بطالة
	الهندسة الكهربائية	7982	2163			●
	هندسة القوى الكهربائية	6280	2978			●
	الهندسة الالكترونية	4550	702			●
	هندسة الميكاترونكس	3084	1998			●
	هندسة الحاسوب	12341	4444			●
	هندسة الاتصالات	8243	3611			●
	الهندسة الطبية الحيوية	2402	1894			●
	الطاقة المتجددة والمستدامة	0	87			●

CHMICAL ENGINEERING JORDAN 2015

شعبة الهندسة الكيميائية	الهندسة الكيميائية وتخصصاتها الفرعية					
	التتخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل		
				مطلوب	مشبع	بطالة
	الهندسة الكيميائية	5785	1191		ذكور / إناث	
	هندسة الصناعات الكيميائية	765	948		ذكور / إناث	
	هندسة صيدلانية وكيميائية	32	161		ذكور / إناث	
	هندسة بيئة	241	173		ذكور / إناث	

MINING ENGINEERING JORDAN 2015

هندسة المناجم والتعدين وتخصصاتها الفرعية

شعبة المناجم والتعدين	التخصصات الهندسية	أعداد المهندسين المنتسبين للنقابة حتى 2015/6	أعداد الطلبة على مقاعد الدراسة في الجامعات الأردنية حتى 2015/6	حاجة سوق العمل		
				مطلوب	مشبع	بطالة
	هندسة التعدين	714	440			●
	الهندسة الجيولوجية	295	177			●

تعتبر نسبة المهندسين في الأردن الأعلى عالمياً مقارنة بعدد السكان
حيث تبلغ هذه النسبة (مهندس لكل 60 مواطن)

عدد الطلبة على مقاعد الدراسة في الجامعات الأردنية (55000) طالب وطالبة

عدد الطلبة على مقاعد الدراسة خارج الأردن (7500) طالب وطالبة تقريباً

Words of Advice from Employers

Employers are looking for graduate who has:

- Teamwork Skills
- Think critically, and solve complex problems
- Excellent communication skills
- Computer/Technical proficiency
- Leadership

Figure 1: Employers rate the importance of candidate skills/qualities

Skill/Quality	Weighted average rating*
Ability to work in a team structure	4.55
Ability to make decisions and solve problems	4.50
Ability to plan, organize, and prioritize work	4.48
Ability to verbally communicate with persons inside and outside the organization	4.48
Ability to obtain and process information	4.37
Ability to analyze quantitative data	4.25
Technical knowledge related to the job	4.01
Proficiency with computer software programs	3.94
Ability to create and/or edit written reports	3.62
Ability to sell or influence others	3.54

*5-point scale, where 1=Not at all important; 2=Not very important; 3=Somewhat important; 4=Very important; and 5=Extremely important

Source: *Job Outlook 2014*, National Association of Colleges and Employers

Prepare for the Job Market?

- Assess Yourself
- Engage in Activities Outside the Classroom
- Sharpen Your Public Speaking and Presentation Skills
- Engage in Networking
- Take Advantage of Internship Opportunities
- Prepare a Current Resume
- Research Your Field
- Prepare for an Interview
- Choose References

Preparing for a Global Career

Students who look to work internationally should:

- Be language and culturally proficient
- Should participate in study abroad programs

Sample Algebra and Functions

This is a test of your ability to solve problems using algebra.

1. Consider the following formula: A = B + 3 (4 - C)
If B equals *5* and C equals 2, what is the value of A?

A.7
B.11
C.12
D.17

2. Consider the following formula: y = 3 (x + 5) (x - 2)
Which of the following formulas is equivalent to this one?

A. y=3x2+9x-30
B. y=x2+3x-lO
C. y=3x2+3x-lO
D. y=3x2+3x-30

3. Consider the following pattern of numbers: 110, 112, 107, 109, 104
What is the next number in the pattern?

A.97
B. 99
C. 106
D.109

4. Consider the following formula: a = 1/2 b - 4
Which of the following statements is true for this formula?

A. When the value of *b* is less than 8, a is negative.
B. When the value of *b* is greater than 8, a is negative.
C. When the value of *b* is less than 8, a is positive.
D. When the value of *b* is greater than 4, a is positive.

Global Future Challenges

Engineering Ethics

- Ethics is a branch of philosophy that involves a recommending concepts of right and wrong conduct.
- The term ethics derives from Ancient Greek (ethikos), meaning 'habit.
- Ethics seeks to resolve questions of human morality by defining concepts such as good and evil, right and wrong, justice and crime.
- Engineering ethics is the field of applied ethics and system of moral principles that apply to the practice of engineering.
- The field examines and sets the obligations by engineers to society, to their clients, and to the profession.

ABET Code of Ethics of Engineers

The Fundamental Principles

1. Engineers shall hold the safety, health, and welfare of the public in the performance of their professional duties.

2. Engineers shall perform services only in the areas of their *competent* .

3. Engineers shall issue public statements only in an objective and truthful manner.

4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.

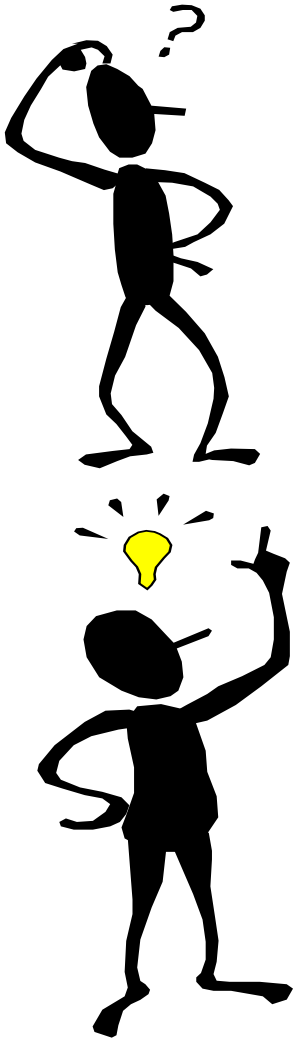
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and self-respect of the profession.

7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

Why important?

- Growing dependency on technology and science.
- Disastrous Consequences
- Public trust and expectation
- Closely related to public and environment.



Question

A person's behavior is always ethical when one:

A. Does what is best for oneself
B. Has good intentions, no matter how things turn out
C. Does what is best for everyone
D. Does what is legal

Law and Morality

Legal & Moral	Designing a system to be safe.
Legal & Immoral	Owning a slave pre-civil war in the US.
Illegal & Moral	Parking in a no parking zone, to come to the aid of an injured person
Illegal & Immoral	Killing a not guilty person.

Legal & Moral	Legal & Immoral
Illegal & Moral	Illegal & Immoral

Common Ethical Issues

- Conflict of interest
- Confidentially
- Whistleblowing
- Safety
- Societal impact
- Gift giving

The Challenger Disaster

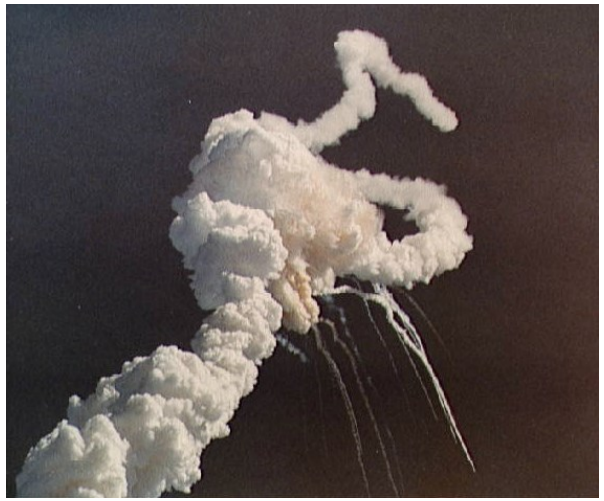
- Managers vs. Engineers
- Robert Lund (Engineer)
  - Recommends against the launch
  - Because of the probability of O-ring failure increases in cold weather
- Jerald Mason (Lund's boss)
  - Asks him to reconsider
  - Asks him to think like a manager, not an engineer

What were Lund's two ethical options?

"To either refuse to authorize the launch"

"To insist that the astronauts be briefed in order to get their informed consent"

"Managers, it might be said, are trained to handle people; engineers, to handle things. To think like a manager rather than an engineer is to focus on people rather than on things."



Challenger Astronauts lost during the Space Shuttle Challenger disaster on January 28, 1986

Volkswagen emissions scandal

Volkswagen emissions scandal

VW admitted in September 2015 it had installed so-called defeat devices in 11 million diesel engines worldwide to make the cars seem less polluting than they were

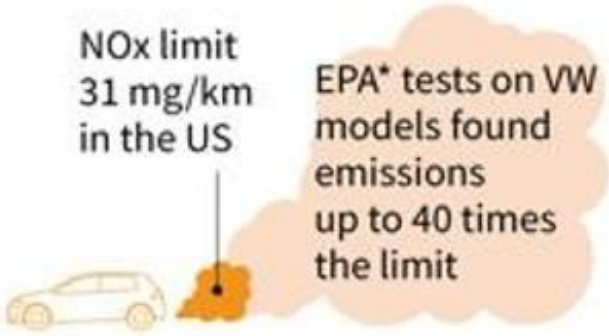
What was the scam?

Defeat devices

- Customised software that programmed diesel engines to detect when a car is undergoing emissions tests
- Turned full emissions controls for **nitrogen oxides (NOx)** on only during the test

What happened at other times?

- Emissions controls were turned off, vehicle emits NOx above legal limits



*Environmental Protection Agency

What does NOx do?

- Linked to increased asthma attacks, other respiratory and cardiovascular illnesses

Source : USEPA/Autonews.com/ICCT/CarThrottle.com

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UNETHICAL CLASSROOM BEHAVIORS

- Signs PRESENT for an ABSENT Friend
- Presents an Answer Sheet of others
- Copies the Work of others
- Cheats in an Examination Room
- Copies Formulae onto Calculators for Use
- Downloads and use Reports on the
- Does not Complete Assignments on Time
- Does not Attend Lectures/Expect to
- Fly By Students in Project Teams

Cheating

- Many components go into being a good engineering student.
- One of the most important, as reflected by the codes of ethics for engineers, is to be ***competent*** in your field of engineering.
- To be competent, it is *necessary* that one actually knows what they claim to know.
- Cheating is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, false, or unfair means.

Why is Cheating Wrong?

- Cheating weakens the credibility of the university and the degrees it awards.
- Cheating also weakens the work of fellow students who are honest.
- When you cheat, all the other students who didn't cheat are punished. They end up getting lower grades.
- Working on a team for an assigned project is *not* cheating.