FSM 2
Ethics and Social Impact of CS

CS 64: Computer Organization and Design Logic

Lecture #17

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Administrative

- Lab 9 (online questionnaire) is posted online and due on Friday by 5:00 PM!

Lecture Outline

- Finite State Machine examples
- Ethics in CS
- The Social Impact of CS

FINAL IS COMING!

- **Tuesday, DEC. 10th** in this classroom
- **Starts at 12:00 PM **SHARP****
- Please start arriving 10 minutes early
- Please bring your UCSB IDs with you

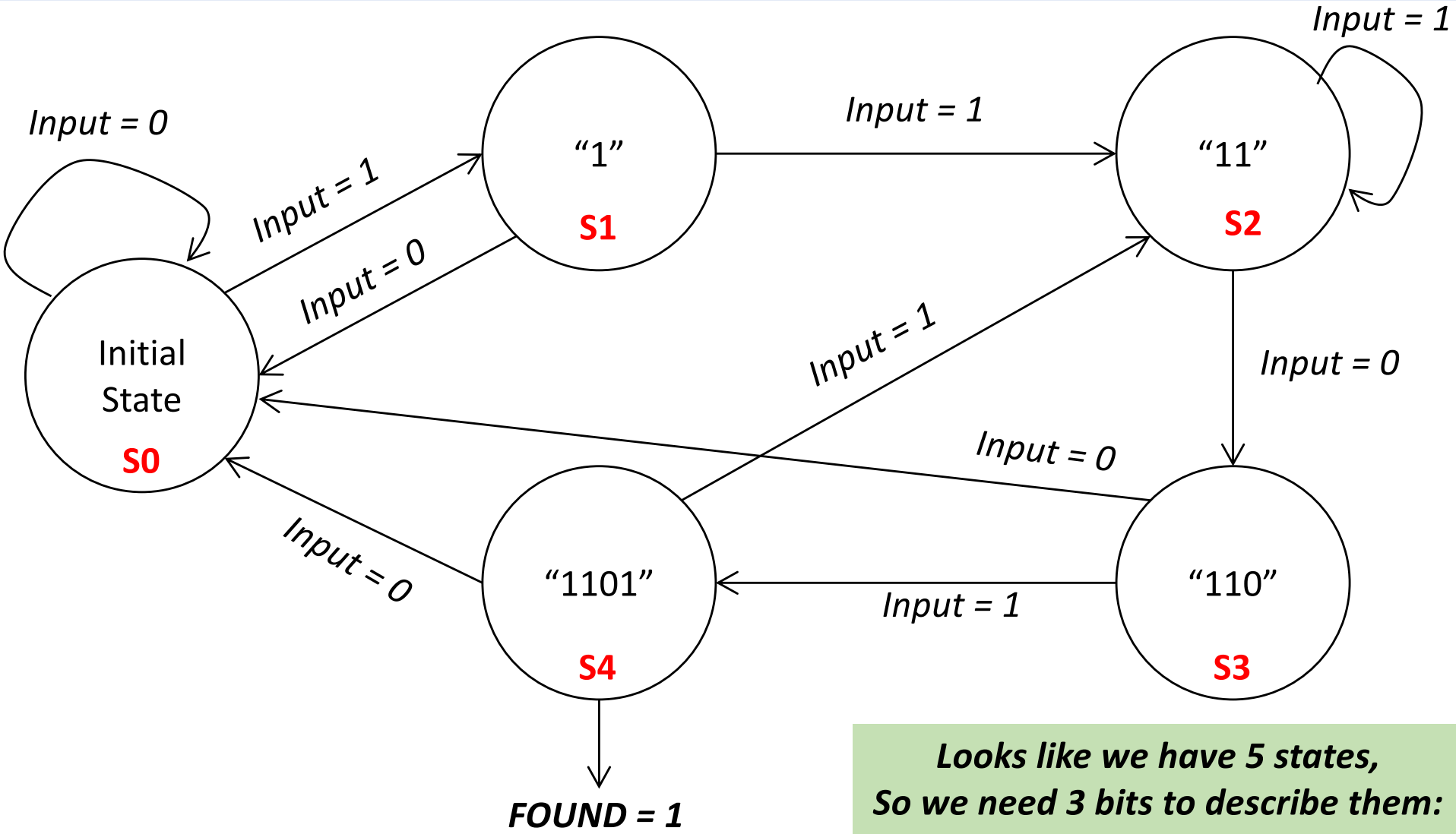
- **Closed book**: no calculators, no phones, no computers (of any kind)

STUDY GUIDE NOW ONLINE!

What's on the Final

- Everything

Recall:
State Diagram for "Detect 1101" Machine



Looks like we have 5 states,
So we need 3 bits to describe them:
Let's call these B2, B1, B0

Representing The States

- How many bits do I need to represent all the states in this "**Detect 1101**" Machine?
- There are 5 unique states (including "init")
  - So, 3 bits
- Recall: FSM circuits use D-FFs
- How many D-FFs should I use to build this machine?
  - 3 bits to describe the state ➔ 3 D-FFs

State	B2	B1	B0
Initial	0	0	0
Found "1"	0	0	1
Found "11"	0	1	0
Found "110"	0	1	1
Found "1101"	1	0	0
N/A	1	0	1
	1	1	X

Designing the Circuit for the FSM

1. We start with a T.T
   - Also called a “State Transition Table”
2. Make K-Maps and simplify
   - Usually give your answer as a “sum-of-products” form
3. Design the circuit
   - Have to use D-FFs to represent the state bits

Note: We are going to ignore the N/A states

1. The Truth Table (The State Transition Table)

CURRENT STATE				INPUT(S)	NEXT STATE			OUTPUT(S)
State	**B2**	**B1**	**B0**	**I**	**B2***	**B1***	**B0***	**FOUND**
Initial	0	0	0	0	0	0	0	0
				1	0	0	1	0
Found “1”	0	0	1	0	0	0	0	0
				1	0	1	0	0
Found “11”	0	1	0	0	0	1	1	0
				1	0	1	0	0
Found “110”	0	1	1	0	0	0	0	0
				1	1	0	0	0
Found “1101”	1	0	0	0	0	0	0	1
				1	0	1	0	1

2. K-Maps

- How many different K-Maps should I have? Why?

- How big should each my K-Maps be? Why?

2. K-Maps for B2* and B1*

State	B2	B1	B0	I	B2*	B1*	B0*	FOUND
Initial	0	0	0	0	0	0	0	0
				1	0	0	1	0
Found "1"	0	0	1	0	0	0	0	0
				1	0	1	0	0
Found "11"	0	1	0	0	0	1	1	0
				1	0	1	0	0
Found "110"	0	1	1	0	0	0	0	0
				1	1	0	0	0
Found "1101"	1	0	0	0	0	0	0	1
				1	0	1	0	1

You need to do this for **all** state outputs

- `B2* = !B2.B1.B0.I`
  - No further simplification

- `B1* = !B2.!B1.B0.I + B2.!B1.!B0.I + !B2.B1.!B0`

B2*

B2.B1 B0.I	00	01	11	10
00				
01				
11		**1**		
10				

B1*

B2.B1 B0.I	00	01	11	10
00		**1**		
01		**1**		**1**
11	**1**			
10				

2. K-Map for B0* and FOUND

- `B0* = !B2.!B1.!B0.I`
  `+ !B2.B1.!B0.!I`

B0*

B2.B1 **B0.I**	00	01	11	10
00		**1**		
01	**1**			
11				
10				

- `FOUND = B2.!B1.!B0`
  - Note that FOUND does not need a K-Map. It is always "1" (i.e. True) when we are in state S4 (i.e. when B2=1, B1=0, B0=0)

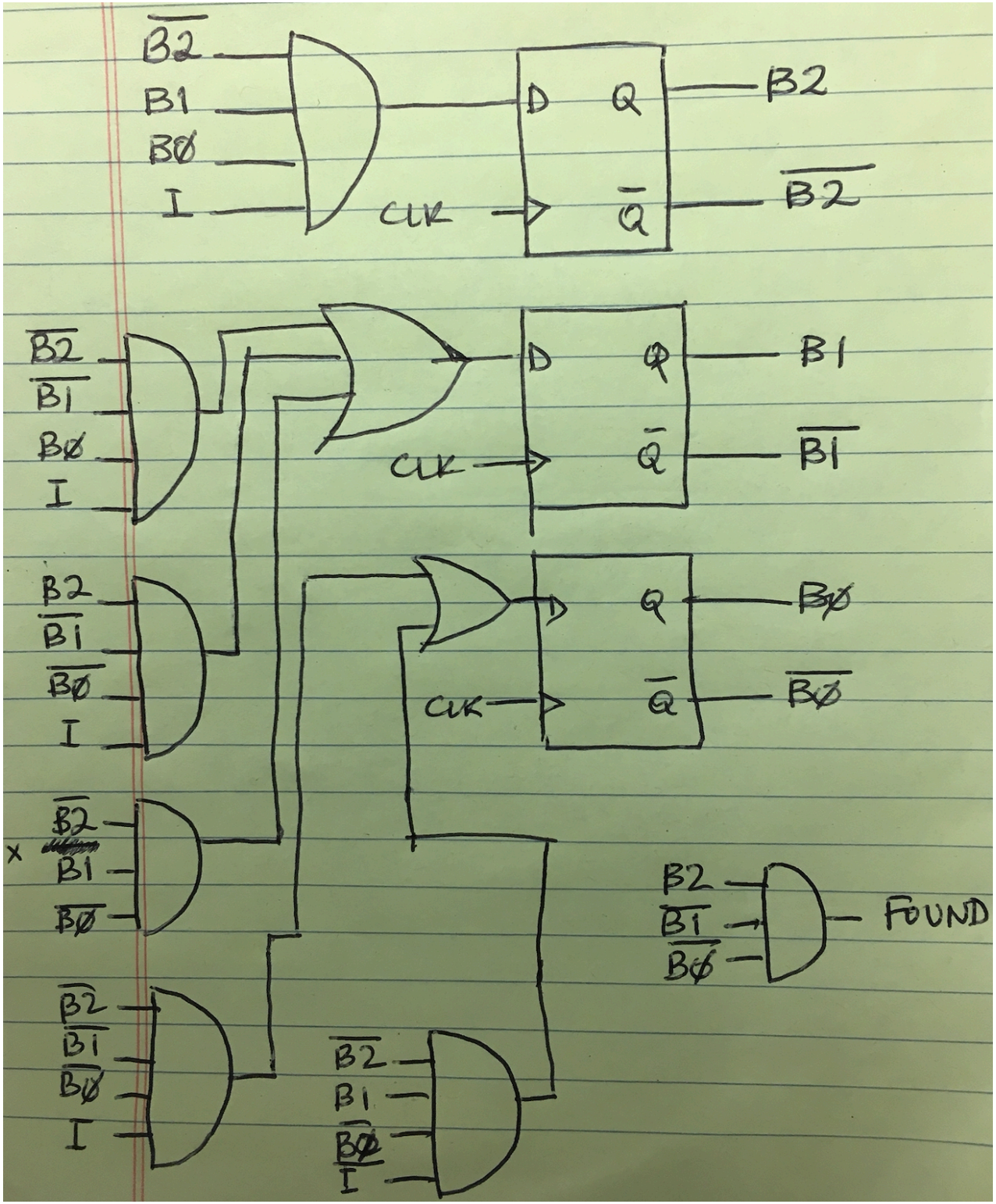
3. Design the Circuit

Note that CLK is the input to ALL the D-FFs' clock inputs. This is a ***synchronous machine***.

Note the use of labels (example: B2 or B0-bar) instead of routing wires all over the place!

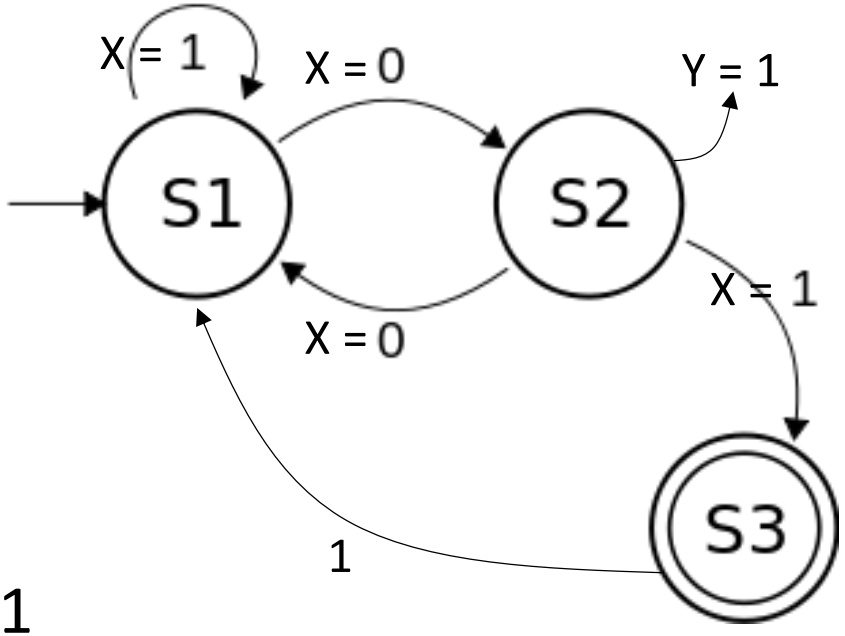
Note that I issued both B*n* and B*n*-bar from all the D-FFs – it makes it easier with the labeling and you won't have to use NOT gates!

Note that the sole output (FOUND) does **not** need a D-FF because it is **NOT A STATE BIT!**



FSM Exercise 1

- Given a FSM described with the following state diagram where:
  - The initial state is S1
  - There is only 1 input, X
  - There is only 1 output, Y, and it is initialized to 0
  - Y becomes 1 only on S2, otherwise it is 0



- What state do you end up in if X takes on the sequential values **0110**?
  - ANS: **S2**
- Which of these inputs will result in Y = 1 at the end of their sequences?

A. 110110
B. 1111101
C. 0101010

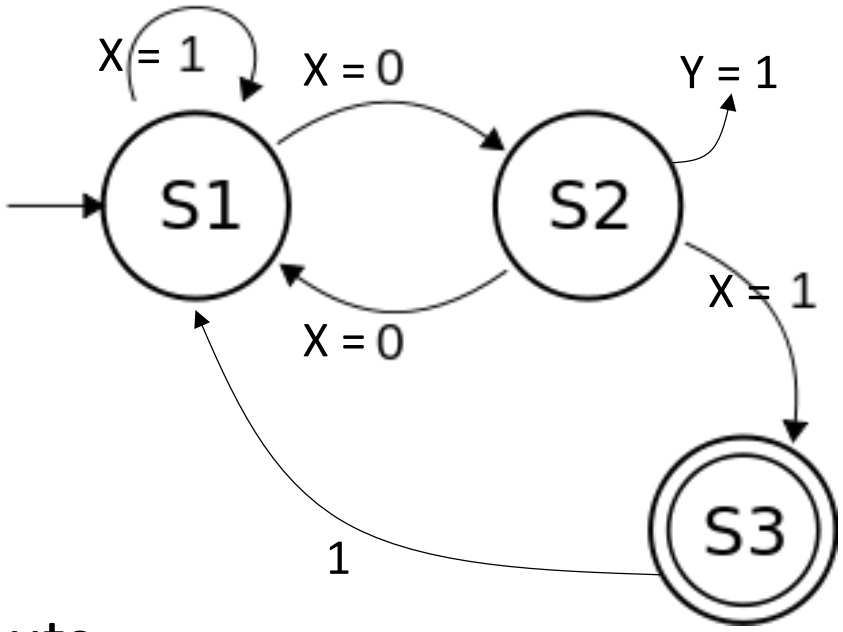
FSM Exercise 1

A. How many bits do we need to represent all the states in this FSM?

B. Write the state transition table for this FSM

C. Write the next-state functions (and output) for this FSM

D. Design the digital logic circuit to implement this FSM, showing all inputs and all outputs



Exercise 1:

3 states ⇒ 2 bits (B_1, B_0)

	B_1	B_0
S1	0	0
S2	0	1
S3	1	0

These choices are arbitrary!

State Transition Table:

B_1	B_0	X	B_1^*	B_0^*	Y
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	0	0	1
0	1	1	1	0	1
1	0	0	0	0	0
1	0	1	0	0	0

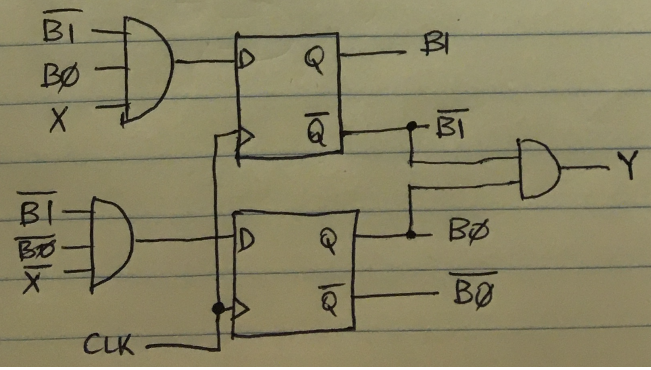
Current State + Input

Next State + Output

→ Output Y depends on the current state

$$\therefore B_1^* = \overline{B_1} \cdot B_0 \cdot X$$
$$B_0^* = \overline{B_1} \cdot \overline{B_0} \cdot \overline{X}$$
$$Y = \overline{B_1} \cdot B_0$$

So:



Ethics

- Moral principles that govern a person's behavior

- Attempts to answer questions like:
  "What is the best way people to do something?"
  "What actions are right or wrong"

- In CS, it's not just about the obvious questions, like:
  "Is it ok to copy someone else's code and use it?" *NO*
  "Can I take this mouse pad from work?" *NO*

  "I mean, come ooooon, it's just a mouse pad..." ***NO!!!***

Ethical Considerations in CS

- Our work in CS affects people (why do it otherwise?!)
  - Ourselves
  - Our work colleagues
  - Our professional community
  - Society at large

Ethics in CS notes the following:

- Our activities and choices affect other people in significant ways
- We have principles and guidelines that guide ethical action

Ethical Considerations in CS

- Act consistently with the **public interest**, your **clients**, your **employer**, your **colleagues**.
- Make your products/services meet the **highest professional standards** possible.
- Maintain **integrity** in your work. Maintain a good reputation for yourself and your profession
- If you're a manager, **promote an ethical approach** to your work and your team's work.
- Keep **bettering yourself** through education

Who Cares if you Aren't Ethical?

- Everyone does – it's a ***"social contract"***

- If you are not ethical, ***at best the following can happen***…
  - … your job will be at risk
  - … your relationship with others will be at risk
  - … you are likely to be negatively labeled as "unethical" in your professional circle
  - … you will give "a bad name" to yourself, your company/employer, and to the field of CS in general

- ***At worst***, you will have **major** financial/legal ramifications
  - Get fired (and possibly blacklisted)
  - Get sued
  - Get arrested

Professional Guidelines

- The IEEECS/ACM Joint Task Force on Software Engineering Ethics and Professional Practices

"Code of Ethics and Professional Practice"

Purpose:

- Documents the ethical and professional obligations of software engineers.
- Instructs us about the standards society expects CS professionals to meet.
- What to expect of one another.

Code of Ethics and Professional Practice

Lab 9 – Task 1

- Read the IEEE Computer Society's article
- Then read a collection of case studies on ethics
  - Both in the lab description

- Afterwards, go to an online form.
  You will choose which *clauses* from the code of ethics are more relevant to each case study.
  - Link in the lab description

The Impact of CS in the World

- What do YOU think Computer Science's impact in the world today is?...

The Impact of CS in the World

- Today – more than ever before – CS enables us to make tools that help people:
  - Connect
  - Visualize information
  - Understand the impacts of
    environmental, economic, energy happenings
  - Collaborate and work together

Google Talk at CSIT Conference

Lab 9 – Task 2

- View video of Megan Smith's talk at the 2010 Computer Science & Information Technology (CSIT) Conference about the Impact of CS Worldwide
  - Smith was a VP at Google and then the "U.S. CTO" and Assistant to President Obama
  - Link is in the lab description

- Afterwards, go to an online form.
  You will identify the impact of CS in a variety of areas.
  - Link is… ahhh… you know where…

YOUR TO-DOs

- Instructor Evals (now)
- Lab 9
  - Online assignment – due Friday at 5:00 PM

BEST OF LUCK ON ALL YOUR FINAL EXAMS!!!

</LECTURE>