As you wait for class to start, answer the following question:

Bob has $500, but owes $300 to Shirley in CA, who’s going to kill him if he doesn’t pay off the money in person in a week. Plane tickets to CA cost $175, while bus tickets cost $75. Based on this, finish off the following statement:

If Bob buys a _______ ticket then Bob won’t be killed.
271: Introduction to Digital Circuits and Systems

- Professor Scott Hauck, EEB-307Q
  (hauck@ee.washington.edu)
  - Office Hours: stop by or email w/schedule for a slot


- TAs (EEB-361):
  - Alvin Cao (asc228@uw.edu)
  - Yana Sosnovskaya (ysos@uw.edu)

- TA Office Hours: most times most weekdays (check website)
Grading

- 20% - Homeworks
- 30% - Labs
- 20% - Midterm Exam
- 30% - Final Exam
- Homework is due at the end of class on the specified date.

- Late penalties:
  - <24 hours: -10%
  - <48 hours: -30%
  - <72 hours: -60%
  - >72 hours: not accepted
Joint Work Policy

- Labs will be done alone, homeworks in groups of 1-2.
  - Students may not collaborate on labs/projects, nor between groups on the specifics of homeworks.
  - All submitted student work must be from their own efforts, and not any other source.

- OK:
  - Studying together for exams
  - Discussing lectures or readings
  - Talking about general approaches
  - Help in debugging, tools peculiarities, etc.

- Not OK:
  - Developing a lab together
  - Checking homework answers between groups

- Violation of these rules is at minimum:
  - Loss of twice the points of that assignment.
  - Report of Academic Misconduct to Dean’s Level.
  - Potentially fail class, be expelled from UW.
Class & Lab Meetings

- Labs:
  - Each student assigned a lab kit, can work where-ever.
  - There are no specific assigned lab times.
  - TAs have large blocks of office hours to help with labs, homeworks, class material, etc.
  - Signups for lab demos will be posted shortly.

- Midterm: Wed, Oct 30, in class
- Final: Wed, Dec 11, 2:30-4:20
Motivation

- Readings: 1-1.4, 2-2.4

- Electronics an increasing part of our lives
  - Computers & the Internet
  - Car electronics
  - Robots
  - Electrical Appliances
  - Cellphones
  - Portable Electronics

- Class covers digital logic design & implementation
Example: Car Electronics

- Door Ajar (DriverDoorOpen, PassDoorOpen):
  \[ DA = DDO \text{ or } PDO \]

- High-beam indicator (lights, high beam selected):
  \[ HBI = \text{lights and HBS} \]
Example: Car Electronics (cont.)

- Seat Belt Light (driver belt in):

  $SBL = \neg (DBI)$

  $DBI \rightarrow SBL$

- Seat Belt Light (driver belt in, passenger belt in, passenger present):

  $SBL = (\neg PBI)_1 \lor (\neg PBI)_2 \land PP$

  $SBL = \neg (DBI) \lor (\neg (DBI) \land PP)$
Basic Logic Gates

- **AND**: If A and B are True, then Out is True
  \[ \begin{array}{c}
  A \\
  B \\
  \hline
  \text{Out}
  \end{array} \]

- **OR**: If A or B is True, or both, then Out is True
  \[ \begin{array}{c}
  A \\
  B \\
  \hline
  \text{Out}
  \end{array} \]

- **Inverter (NOT)**: If A is False, then Out is True
  \[ \begin{array}{c}
  A \\
  \hline
  \text{Out}
  \end{array} \]
TTL Logic

Vdd (TRUE)

GND (False)
Digital vs. Analog

Digital:
- only assumes discrete values
- Binary/Boolean (2 values)
  - yes, on, 5 volts, high, TRUE, "1"
  - no, off, 0 volts, low, FALSE, "0"

Analog:
- values vary over a broad range continuously
Advantages of Digital Circuits

- Analog systems: slight error in input yields large error in output
- Digital systems more accurate and reliable
  - Readily available as self-contained, easy to cascade building blocks
- Computers use digital circuits internally
- Interface circuits (i.e., sensors & actuators) often analog

This course is about logic design, not system design (processor architecture), not circuit design (transistor level)
Combinational vs. Sequential Logic

**Sequential logic**

- Network implemented from logic gates.
- The presence of feedback distinguishes between **sequential** and **combinational** networks.

![Diagram of Sequential Logic]

**Combinational logic**

- No feedback among inputs and outputs.
- Outputs are a function of the inputs only.

![Diagram of Combinational Logic]