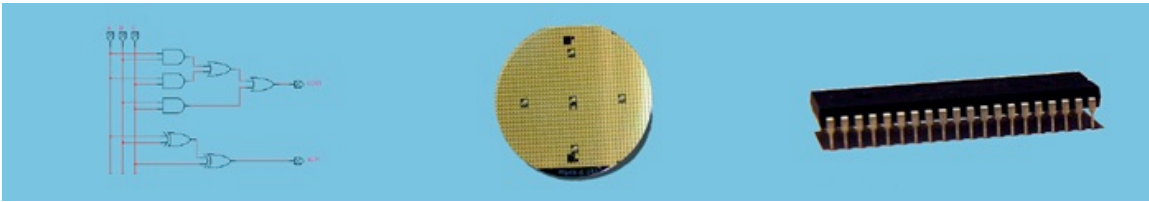




CE1900 WEEK 1 LABORATORY EXERCISES



LABORATORY SUMMARY

The first laboratory period occurs too early in the quarter to apply lecture theory to design tasks. Thus, the first laboratory exercise requires students to install the laboratory design software and use the software for the first time to create a digital logic circuit blueprint.

Students will complete multiple design tasks:

- **Install** the Quartus toolset.
- **Enter** a schematic design.
- **Simulate** the design to verify operation.

The laboratory exercises reinforce these CE1900 learning objectives:

- **Use** schematic entry to design and simulate arithmetic circuits.

Note that much of the material in the tutorial will be unfamiliar because lecture has not covered the topics yet. **Don't worry!** Simply complete the exercises by following the tutorial steps.

Print this document and **demonstrate** the completion of the software installation to your instructor during office hours this week or at the start of the week 2 lab period.



CE1900 WEEK 1 LABORATORY EXERCISES

PRACTICE PROBLEMS

Test your progress in meeting your course learning objectives by completing these practice problems. Practice problems are for your personal study and may be collected and checked as part of your overall lab grade. **Ask** your instructor for help if needed.

1. **Describe** how a digital signal **differs** than an analog signal.
2. **List** the binary powers-of-2 in order from 2^0 to 2^{16} .
3. **Compare** and **contrast** base-10 numbers and base-2 numbers. **Compare** means to describe how they are similar. **Contrast** means to describe how they are different.
4. **Explain** how base-5 numbers would be written using the standard Arabic numerals beginning from 0. **Include** information about each column and what it represents. **Provide** an example by converting decimal number 2013 to base-5.
5. **Explain** why the least significant bit can be used to determine if a binary number is even or odd.
6. **State** the maximum positive number that can be written as a 12-bit number. **Explain** your answer by showing a general equation that can be used to find the maximum of any n-bit representation.
7. **Write** base-16 number C9 as a decimal number and as a binary number.
8. **Convert** binary number 10100111 to hexadecimal.
9. **Convert** hexadecimal number 0x9E4F to binary.
10. **Complete** this table of unsigned, positive values.

| DECIMAL (BASE-10) | 8-BIT BINARY NUMBER (BASE-2) |
|-------------------|------------------------------|
| 21 | |
| 126 | |
| | 11111011 |
| 255 | |
| 40 | |
| | 01010101 |
| 112 | |
| | 11001001 |
| | 00011010 |
| 36 | |



CE1900 WEEK 1 LABORATORY EXERCISES

SOFTWARE INSTALLATION AND TUTORIAL

Each student must complete these exercises before coming to the week 2 laboratory period.

1. **Install** the Quartus toolset. **Follow** the “Installation Instructions” given under the **Design Software** link of the CE1900 website (<http://faculty-web.msoe.edu/~meier/ce1900>).
2. **Complete** the MSOE schematic tutorial found as Item 3 under the **Design Software** link of the CE1900 website. **Note** that a second tutorial written by the Altera Corporation is also listed. Feel free to scan that one but it is not required.
3. **Demonstrate** your preliminary lab tutorial work to the instructor. The instructor will complete the signature block at the end of this document. The signature block serves as proof that you have completed all prelaboratory exercises and met your demonstration requirement. **Keep** this document in your binder for CE1900 in case you need to refer to it in future work or in case the instructor asks to see the signature block again at a later date.
1. **Estimate** the total amount of time you spent working on the pre-lab and lab exercises. **Record** that time in minutes: _____ minutes.

FOR INSTRUCTOR USE ONLY: DO NOT WRITE IN THIS TABLE

| ITEM | COMMENTS |
|---|----------|
| Demonstrates Quartus blueprint skills. | |
| Demonstrates Quartus simulation skills. | |
| Completed all preliminary lab work. | |

Instructor Signature: _____