LAB GUIDELINES

For each laboratory experiment, the pre-lab work and the lab work are clearly indicated. It is the responsibility of each student to complete all pre-lab work before coming to the lab to perform an experiment. A student is not allowed to attend a lab if he has not done the pre-lab work for that lab.

- Copying of pre-lab from any source is strictly **NOT** tolerated.
- Pre-lab write-up must be **typed** in the same format as the Lab report.
- Handwritten pre-lab report is not accepted.
- Draw all and tables in MS Word or MS Visio.
- **All circuit diagrams must be drawn and simulated in LogicWorks after Experiment #3.**
- Pre-lab work is clearly indicated for each experiment. No excuse for not being able to do the pre-lab work.
- All circuit parts with pin numbers should be included in the pre-lab so that the circuit can be readily connected on the proto-board in the lab. This also saves a lot of time in the lab.
- The lab manual and the chip diagrams must be brought to the lab at all times.

During the lab, each student may be asked about the simulation results. Try to investigate all possible changes on the circuit to acquire full knowledge about your design.

Students should work in groups of 2 each. The pre-lab results from each student in the group should be compared and the design that produces the best results should be implemented using hardware parts. You must also comment on the simulated and experimental results.

Grading Policy:

A general grading policy is as follows:

Pre-lab Work:	**20 %**
Quizzes:	**20 %**
Lab Work:	**30 %**
Lab Final:	**30%**

LAB PROCEDURES

1. Turn power switch off before you start building your circuit.

2. Refer to the handout diagrams (or TTL data book) to determine the input and output pins as well as Vcc and GND pins for each gate in the chip. Diagrams handout is supplied to you which you must bring with you to all labs.

3. Handle all IC's with care.

   - **Inserting IC's –** Insert all IC's carefully on the breadboard.
   - **IC Orientation** - Arrange all IC's in the same direction. This will facilitate connecting Vcc on each IC to a 5V strip on the breadboard and GND on each IC to a ground strip. It is recommended that you begin wiring by making all Vcc and GND connections.
   - **IC Removal** - It is recommended that you use some sort of tool for removing IC's. Attempts to remove IC's by hand may result in bent pins.
   - **Damaged IC**'s: Damaged IC's must not be mixed with the good ones. They must be properly disposed into a special box for damaged IC's available in the lab.

4. Layout all necessary components and do all wiring on your breadboard. Color coding your wires is a good way to eliminate errors. Also, designate a side for the 5 volt power supply and a side for ground.
   - **Wire color** - Use organized color schemes when wiring circuits. For example, use RED wire for all Vcc connections, BLACK wire for all ground connections, BLUE wire for all input switches, and YELLOW wire for all intermediate signal connections.
   - **Wire length and placement** - Use wires that are the appropriate length so that they can lie flat on the breadboard. Avoid running wires over IC's in case the IC's need to be removed.

   Note: Organized circuit layouts are easier to inspect and debug when needed!

5. Always verify that all connections on your breadboard are correct. Check for the leads to the 5 volt supply and ground, and the logic gate inputs and outputs.

6. Make sure you know which switches are used for which input signal.

7. Once you have built and tested your circuit, demonstrate each circuit to your lab instructor. Make sure that all cases mentioned in the lab manual are considered.

8. Always remember to **TURN OFF** the power supply before you pull out any wires or chips; otherwise this may damage a chip.

9. Clean up your bench when you are finished.

LAB REPORT FORMAT

Each student should write his own report. The lab reports are intended to serve two equally important purposes. First, they indicate your technical comprehension of the topics addressed in the labs, and second, they indicate your ability to present and discuss your results in a clear and concise manner. You will be graded on both aspects of your report.

The suggested format for your lab report is given below.

1. **Objectives:** State clearly what you set out to achieve in this lab. If this differs from what you finally achieved, explain it in the "Conclusions" section. Please do not copy the objectives word-for-word from the lab handout. Think about it, interpret it, and explain it the best you can, in your own words.

2. **Equipment and IC's:** List all the parts you used in the design.

3. **Design and Test Procedure:** For *each subsection* of the lab, explain the following:

   (a) Step-by-step description of what you did. Include as many details as possible, and once again, write it in your own words.

   (b) All necessary calculations as well as all pin-to-pin circuit diagrams of your design. Please make sure your figures are consistent, clear and well labeled.

   (c) Your testing procedure. Explain how you went about testing your design. Did you try testing critical individual blocks first?

4. **Results and Answers to Questions:** For *each subsection* of the lab, present your results in a clear and concise manner (label graph axes, include all units of measurement). Note down all your observations, even if you were not specifically asked for them in the handout. Interpret your results and discuss the accuracy of your measurements. Additionally, answer all questions listed in the lab handout.

5. **Conclusions**: In this section you should attempt to answer the questions: What did you learn from this lab? What did you do wrong (or what went wrong)? How could you have improved upon your design and test procedures? Were your results as expected or did you find something unusual. Try not to include information that you have included in previous sections. Present the significance of your results conceptually, if applicable, (e.g. The CAD tool does not capture the glitch behavior accurately).