COE 561, Term 091
Digital System Design and Synthesis
Course Project

The list of course projects proposed for this term are as shown below. In each project, the main objective of the project and the expected team members are specified. Each student must select a project according to the deadlines specified below.

1. Reliability-Driven Don't Care Assignment for Two-Level Logic Synthesis [2 Students]

Recently, an algorithm for the selective assignment of don't cares to enhance the reliability of two-level logic circuits has been proposed. The algorithms use a Hamming-distance based metric to determine 0/1 assignments for the most critical don't care terms, thereby leaving flexibility in the circuit specification for subsequent area minimization. This algorithm has been implemented in C language. In this project, the students will verify the correctness of the implemented algorithm and generate results on benchmark circuits based on running espresso, SIS, ABC synthesis tool and reliability analysis based on simulations.

2. Implementation of ITE DAG [2 Students]

In this project, the students will implement the ITE procedure and display the obtained ITE DAG in a graphical format. The input to this procedure is the three functions f, g, and h. It can be assumed that these functions will be specified in equation format. The tool will also accept the variable order to be used in the implementation of the ITE DAG. The output will be the reduced ITE DAG. Since this tool is meant for educational purposes, the students are required to have a debugging option where he displays the execution steps of the algorithm in a user friendly format to allow students to follow the algorithm execution. Initial implementation of the tool was done in C language. The students will verify the correctness of the implementation and implement missing functionality.

3. Heuristic-Based Two-Level Logic Minimization Based on Covering [2 Students]

In this project, the students will implement heuristic based two-level minimization based on solving a covering problem heuristically. First, the prime implicants of a two-level function will be computed based on the studied procedure. Then, the problem will be formulated as a covering problem and solved heuristically after applying matrix reduction procedures including essential columns, row dominance and column dominance. Then, a column will be selected based on the highest number of rows covered. Input to the developed tool is assumed to be in PLA format. The students will generate results on benchmark circuits and compare their obtained solution with espresso exact and espresso heuristic algorithms.

4. Simulated Evolution Based State Assignment for Power and Testability [3 Students]

State assignment (SA) for Finite State Machine (FSM) is one of the main optimization problems in the synthesis of sequential circuits. The SA of an FSM determines the complexity of its combinational circuit and thus area, delay, testability and power dissipation of the implementation.
In this project, the students are required to use the Simulated Evolution (SE) algorithm to derive state assignments that optimize the power dissipation of the circuit and improve testability. The simulated Evolution algorithm has been employed for area optimization. Functions for computing Power and Testability costs have been implemented. Students will also employ a fuzzy-based aggregation to combine the ability. Students will generate results on benchmark circuits and will use an existing tool developed using the C language.

Project Deadlines:

Task	Deadline
Project selection	Tuesday, Dec. 8
Project Plan	Tuesday, Dec. 15
Progress Report	Tuesday, Jan. 5
Final Report & Project Demonstration	Tuesday, Jan. 26

Each student group is expected to submit a project plan describing the project tasks, the time planned for each task, and the team members' role in each task. Each group is also required to submit a progress report describing briefly the progress made so far in the project against planned work, difficulties faced, results obtained so far and the tasks to be performed in the next period. At the end of the project, each group is required to submit a professional report showing the details of all the work performed and demonstrate their project to me.

Project Evaluation Criteria:

Task	Mark
Project Plan	5%
Progress Report	10%
Project Accomplishments vs. Requirements	60%
Final Report Documentation & Organization	25%