

CS 613200 Advanced Logic Synthesis

Homework 1 (2026, Fall)

Due Date: 2026/4/13

OBJECTIVE

Based on the knowledge given in class, **evaluate** and **analyze** logic synthesis tool, SIS and ABC.

Upload the Chinese (recommended) / English report (max 4 pages) to eeclass and also hand in a printed copy by **2026-04-13**.

About ChatGPT: Don't use NLP model to generate your report !!!

INTRODUCTION

SIS (A System for Sequential Circuit Synthesis) and ABC (A System for Sequential Synthesis and Verification) are academic tools developed by UC Berkeley. They are used for synthesis and optimization of binary sequential logic circuits appearing in synchronous hardware designs.

In this project, you will use these tools to optimize circuits in logic level. Several logic optimization techniques are introduced in our class. These techniques can be applied to circuits through commands in SIS and ABC environment. To optimize a circuit with these techniques, several commands with proper parameters are executed iteratively. For different optimization objectives and for circuits with different characteristics, different scripts are used.

Reference Process:

1. Select **all** test benches from **benchmark set** (you can download it from course website).
2. Carefully read the file: ***abc_sis_introduction_2026_3_30.pdf***
3. Use the scripts provided in **SIS** and in **ABC** to **optimize (# AIG nodes, level)** them (you can define new scripts by yourself).
4. Try to understand and explain the purpose of these scripts based on experiments.
5. Compare the optimization efficiency of **SIS** and **ABC** in terms of **quality** and **runtime**.

TOOL INFORMATION

A. General Information

You can obtain information about tools on our [website](#). The “**Description**” of each tool includes a link to its explanation.

B. NTHU CAD Servers, using host: ic51, ic55~58

C. How to run:

- a. Download executable file of SIS, ABC, and Benchmark from our [website](#). (If you want to know more details of tool, you can download the source code)
- b. SIS: `./sis`
- c. ABC: `./abc`
- d. Benchmark: Copy the benchmark to your working directory

About ABC9

ABC9 is a modern synthesis and mapping package within the ABC tool, built on the GIA (Gate-level Intermediate Representation) manager. This flow is accessed via commands starting with '&'. Compared to the traditional AIG flow, ABC9 offers higher efficiency, better scalability, and more advanced mapping algorithms. You are encouraged to explore these GIA-based commands and compare their performance with traditional AIG-based approaches.

Recommend ABC & ABC9 command:

- *strash*
- *rewrite*
- *refactor*
- *balance*
- *&Rewire*
- *&deepsyn*
- *&ttopt*
- *&transduction*

- *&eslim*
- *clp*
- *reorder*
- *muxes*
- *dch*
- *amap*
- *collapse; {sop; fx, dsd, bidec}*

Please note that the data structures for certain commands may involve Boolean networks, SOP forms, BDDs, or truth tables instead of AIGs. You should leverage AI tools such as *Codex*, *Claude Code*, *gemini cli* or *Cursor* to understand how these commands work and how they differ in terms of solution space and exploration efficiency, then proceed to design and analyze your experiments.

HINTS

About Tools:

1. [A Tutorial of Usage and Programming of SIS](#)
2. [A Tutorial of ABC](#)
3. [Github: ABCPaperCheck](#)

About reports:

Use any format for your assignment.

If you have any questions, post them in the EECLASS discussion board.

TA: 王睿杰 | 唐梧遷

Email: wrj651121@gmail.com | towne.cpp@gmail.com