# Assignment# 2

**CSE 530, Fall 2022**

---

**Note:**

- **Please include your name and PSUID on the first page.**
- **Submit all files on Canvas.**
- **The assignment must be submitted on Canvas before the due date (11 p.m.).**
- **No single line answers are accepted in the submission.**
- **Late submission will not be accepted unless prior approval (24hr before the deadline) is taken from the Instructor or TA on the ground of medical/personal emergency or academic deadlines.**
- **No kind of collaboration is allowed unless specifically mentioned in the assignment.**
- **All source materials must be cited.**
- **The University Academic Code of Conduct will be strictly enforced.**
- **All queries related to Assignment should have a subject line CSE530: Assignment#2 queries**

---

## Goal:

Analyze the impact of associativity and cache size on energy, area, and access time.

## Tools required:

Cacti 7.0 [1]

## Using Cacti tool:

i. **Steps to set up the environment:**

$ git clone https://github.com/abhishekk06/cacti.git

$ make

ii. **Steps to run Cacti:**

$ */path/to/git-repo/cacti* -infile <*config_file.cfg*>

## Experiment details:

Perform a sweep of cache size and associativity to study the following:

1. **Area**
   - Impact of increasing cache size on the area of data array with fixed associativity (8)
   - Impact of increasing associativity on the area of data array with fixed cache size (256 KB)
2. **Energy**
   - Impact of increasing cache size on total dynamic read energy per access for the data array with fixed associativity (8)
   - Impact of increasing associativity on total dynamic read energy per access for the data array with fixed cache size (256 KB)
3. **Access time**

- Impact on the access time with varying associativity and fixed cache size (1 MB).
- Impact on the access time with varying cache size (range: 64 KB to 2 MB) and fixed associativity (8).

Prepare a **PDF report** with your observations and reasoning for the trends in the energy consumption, area, and access time with change in associativity or cache size.

**A baseline configuration is given to you as part of the repository. Refer to the file -- cache.cfg in the cloned repository.**

You may write a script in your favorite scripting language to (1) edit and save the cache.cfg with "user inputs" of cache size and associativity, (2) feed the edited cache.cfg to Cacti as per the command *"/path/to/git-repo/cacti -infile <config_file.cfg>*", (3) Collect results from the generated output from Cacti and (4) plot the observed behavior with your favorite plotting tool. You are expected to submit all your scripts, generated configs, and other relevant source code (via a zipped file). An example plot is shown in Figure-1.

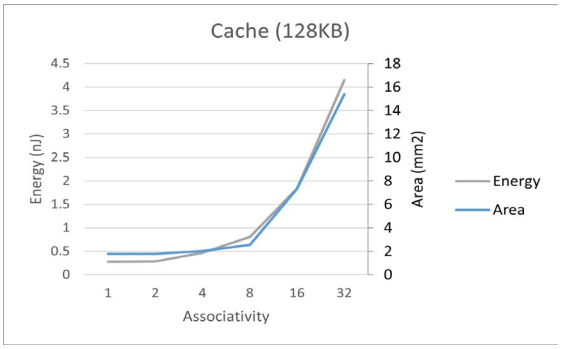


Figure 1: Impact of varying associativity for a 128 KB cache on energy and area

**References:**

[1.] Naveen Muralimanohar, Rajeev Balasubramonian, and Norman P. Jouppi CACTI 7: New Tools for Interconnect Exploration in Innovative Off-Chip Memories ACM Transactions on Architecture and Code Optimization, Volume 14, Issue 2, July 2017 Article No.: 14pp 1–25, https://doi.org/10.1145/3085572