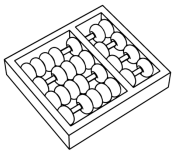

Institute of Computing – UNICAMP
MO632/MC972 – Energy Efficient Computing
First Semester, 2019
Prof. Lucas Wanner

UNICAMP

Course Description: Inadequate battery lifetimes are cited as one of the main concerns for smartphone users. On the other end of the computing scale, data centers are one of the largest and fastest growing consumers of electricity. While energy efficiency in hardware has historically scaled at roughly the same pace as transistor densities, batteries and electrical grids cannot keep up with the growing demand for computing power. Systems and applications can therefore no longer remain oblivious to their energy usage. In this course we will cover hardware, architecture, software, and networking aspects of energy efficiency. Students will review the recent literature on energy-aware computing and work on a practical energy-aware software project.

Schedule: Tue 8-10, Thu 10-12, IC-352.

Office Hours: Scheduled on-demand via email (`lucas@ic.unicamp.br`)

Website: `http://www.lucaswanner.com/eac`

Prerequisites: Students should be familiar with computer architecture and low-level programming. MC404 (or an equivalent course) is strongly recommended. MC504 and MC602 are recommended but not required.

Program: • Measurement, sensing, and modeling of energy consumption • Process, Voltage, and Temperature (PVT) variations • Hardware-level techniques • Dynamic power management • Energy proportionality • Duty cycling • Energy and Power-Aware Scheduling • Energy bugs • Low-Power networking • Battery modeling and management

Course components:
Literature review: (L) Students will write a one-page review of selected papers. One student will present and lead the discussion for each paper in class.
Take-home exams: (E) including theoretical, analytical, and practical (implementation) problems.
Project (P): practical implementation project, including implementation, evaluation, presentation and paper describing the results. Depending on complexity, two or more students may work together on a single project.

Grading: Final grade F will be given by:

$$F = L \times 0.3 + E \times 0.3 + P \times 0.4$$

where L is the arithmetic mean of the grades for the literature review assignments, E is the arithmetic mean of the grades for the take home exams, and P is the grade for the project. MO632 students will be awarded letter grades according to the following criteria: A: $F >= 85$, B: $85 > F >= 70$, C: $70 > F >= 50$, D: $50 > F$. No makeup or supplementary exams will be offered.

Bibliography:

• Jan Rabaey. Low Power Design Essentials. Springer, 2009.
• Massoud Pedram and Jan Rabaey. Power Aware Design Methodologies. Springer, 2002.
• Ishfaq Ahmad and Sanjay Ranka (editors). Handbook of Energy-Aware and Green Computing. Chapman and Hall/CRC, 2012.
• Brian Otis and Jan Rabaey. Ultra-Low Power Wireless Technologies for Sensor Networks. Springer, 2007.
• Recent papers from the energy-aware computing literature.

Academic integrity: Any attempts at plagiarism and receiving or giving aid on assignments will result in a final grade of zero in the course.