# How important is it for students to have specific components of VLSI education?

**Important for undergraduate education**

- Intro and advanced courses
- Device manufacturing/modeling
- Experience with contemporary processes
- Commercial CAD tool experience
- Team projects/large scale projects
- Fabrication and/or testing experience
- Scripting/Unix/Linux/System Administration

# What's missing from VLSI education?

**Push courses for undergraduate education**

- SOTA end-to-end design flow and management
- Digital-analog mixed signal basics, e.g. SERDES, PLL, I/O drivers
- Design for testing and manufacturing, e.g. Scan, SRAM BIST & Repair
- Basic and advanced packaging
- Integrated photonics

# How can open-source hardware and EDA tools help? What are the problems with open-source hardware and EDA?

- OS EDA tools enable much more VLSI research activities
  - Commercial (end-to-end) license too expensive for research-oriented labs
- OS hardware designs enable much more complex and larger scale projects
  - Research-oriented labs have limitations in managing and sharing designs/IPs
- OS EDA tools lack capabilities in large scale, end-to-end design automation, sign-off quality for SOTA manufacturing, packaging, etc.
- OS hardware designs lack of verification/validation, documentation, standard compliance, sometimes complete functionality.

# How can we increase hiring pools? How can we increase undergraduate enrollments?

- Comprehensive undergraduate course structure specializing in VLSI.
- Make VLSI design and engineering required knowledge and skill for undergraduate.
- Computer engineering undergraduate degree in most of universities/colleges.
- Grants, scholarships and incentives for undergraduate VLSI engineering study.