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DEPARTMENT OF COMPUTER SCIENCE

Software Development Laboratory <SDML>

Software Development: Research, Education, & Industry

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What is Software?

- Software = **Instructions** that tell hardware what to do.
- Hardware = The body (physical parts like screens, keyboards).
- Software = The brain (invisible logic that makes it work).
- Software is everywhere in the modern day:
  - The car or bus you took to get here
  - The websites you visit daily
  - In your pocket - phone, laptop
  - …



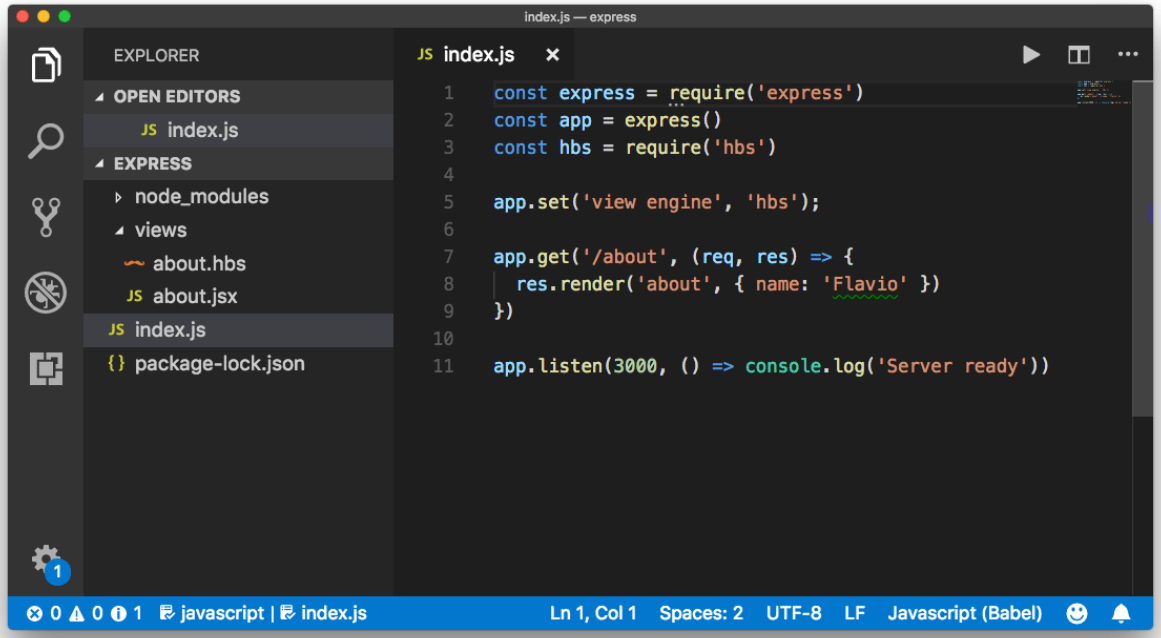
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What is Software Made of?

- Code!
- We write code using programming languages
  - C++, C#, Python, Java, and hundreds more!
- This code becomes **instructions** (in binary) that your devices can understand and follow
- Example: **print("Hello, World!")**



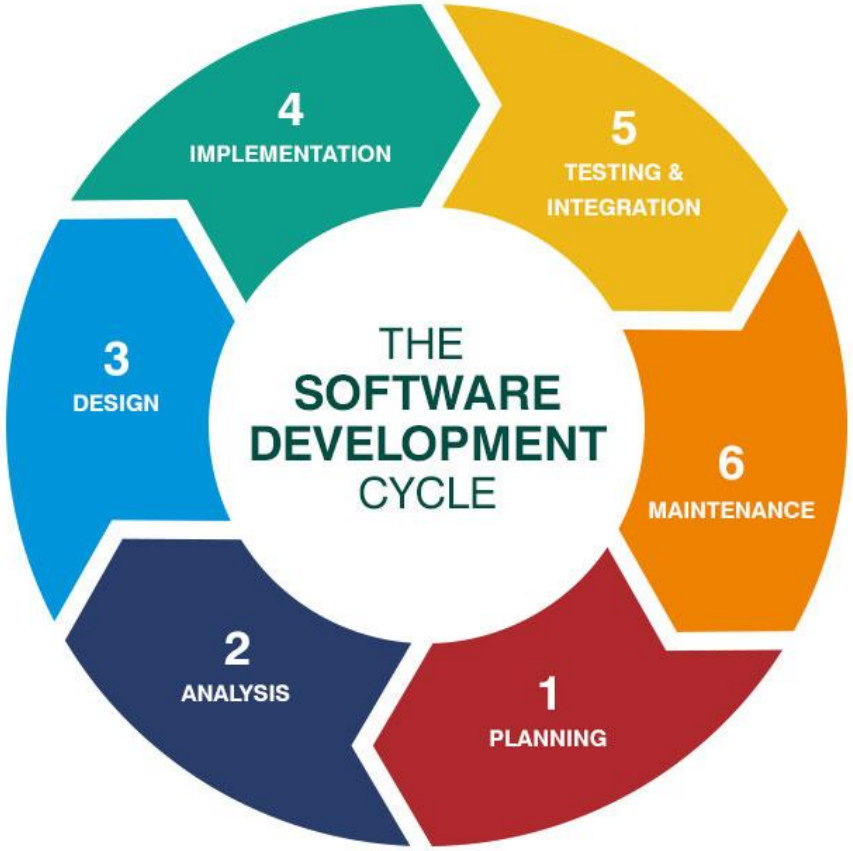
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What is Software Engineering?

- **Software engineering** is a field within computer science focused on developing, maintaining, and evolving software
  - **Designing**: planning how it will look and work
  - **Creating**: writing code
  - **Testing**: checking for errors and making sure it works
  - **Evolving**: updating and improving it



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When Software Goes Wrong

- Software errors can be very **costly** and **damaging**!
- Infamous example: Ariane flight V88
  - Ariane 5 rocket reused code from the Ariane 4 rocket
  - This code worked perfectly for Ariane 4, so no problems were expected
- **Issue:** Ariane 5 accelerated faster than Ariane 4, ultimately causing an integer overflow
- Not tested properly!
- $370M in damages (750M today)



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Software Engineering Courses

- As a part of the computer science program, you will have courses that teach basic programming in C++
  - CS 13011 Computer Science I – C++ basics
  - CS 23001 Computer Science II – Testing, data structures
  - CS 44001 Computer Science III – Standard library, design patterns
- Additionally, you will have courses focused on software engineering
  - CS 33901 Software Engineering
  - CS 49999 Capstone/Software Development Project

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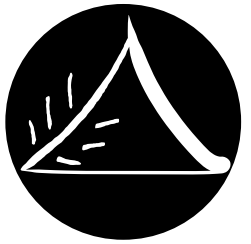
Software Engineering Research

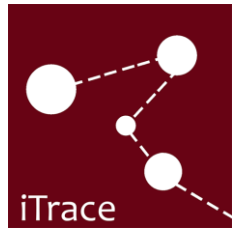
- Current research at KSU in software engineering includes:
  - How developers write code
  - How developers read and understand code
  - Developing tools to mitigate bugs and bad design programs

- Projects funded by the National Science Foundation: srcML, srcDiff, iTrace









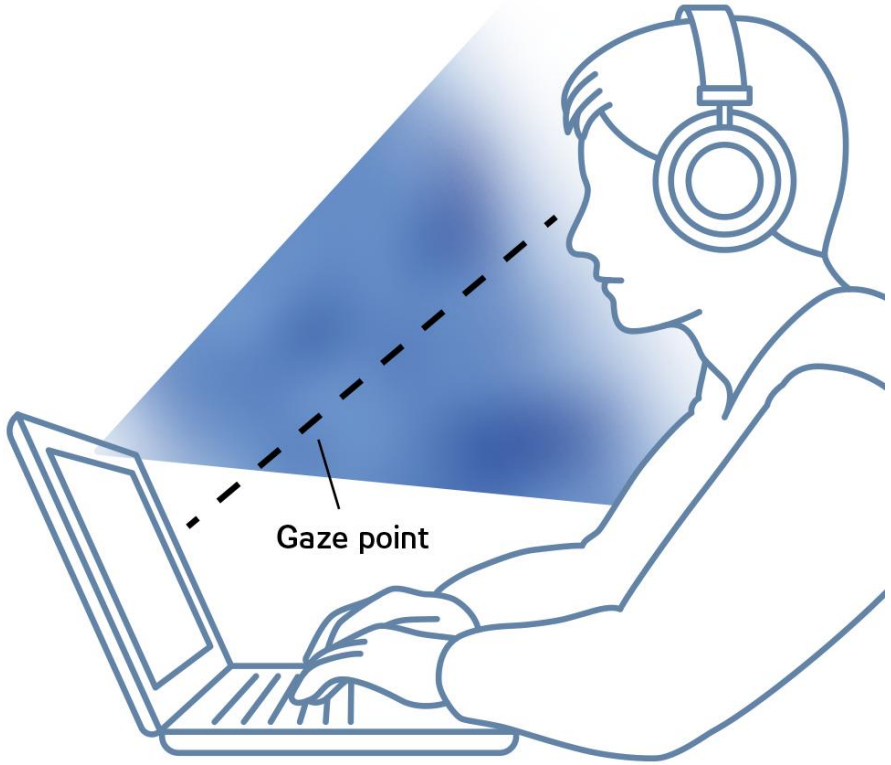
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How do developers read code?

- If we understand how current students and developers read code, we can:
  - Identify issues in code
  - Improve how code is written and maintained
  - Develop better coding practices
  - Develop better programming tools



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Undergraduate Research Experiences

- Many opportunities for software engineering research as an undergraduate!
- Get involved through:
  - Choose Ohio First (COF) Scholarship
  - Summer Undergraduate Research Experience (SURE)
  - NSF Funded Research Experience for Undergrads (REU)
  - Elective credit
- Funding opportunities available!

Choose Ohio First

SURE Summer Undergraduate Research Experience

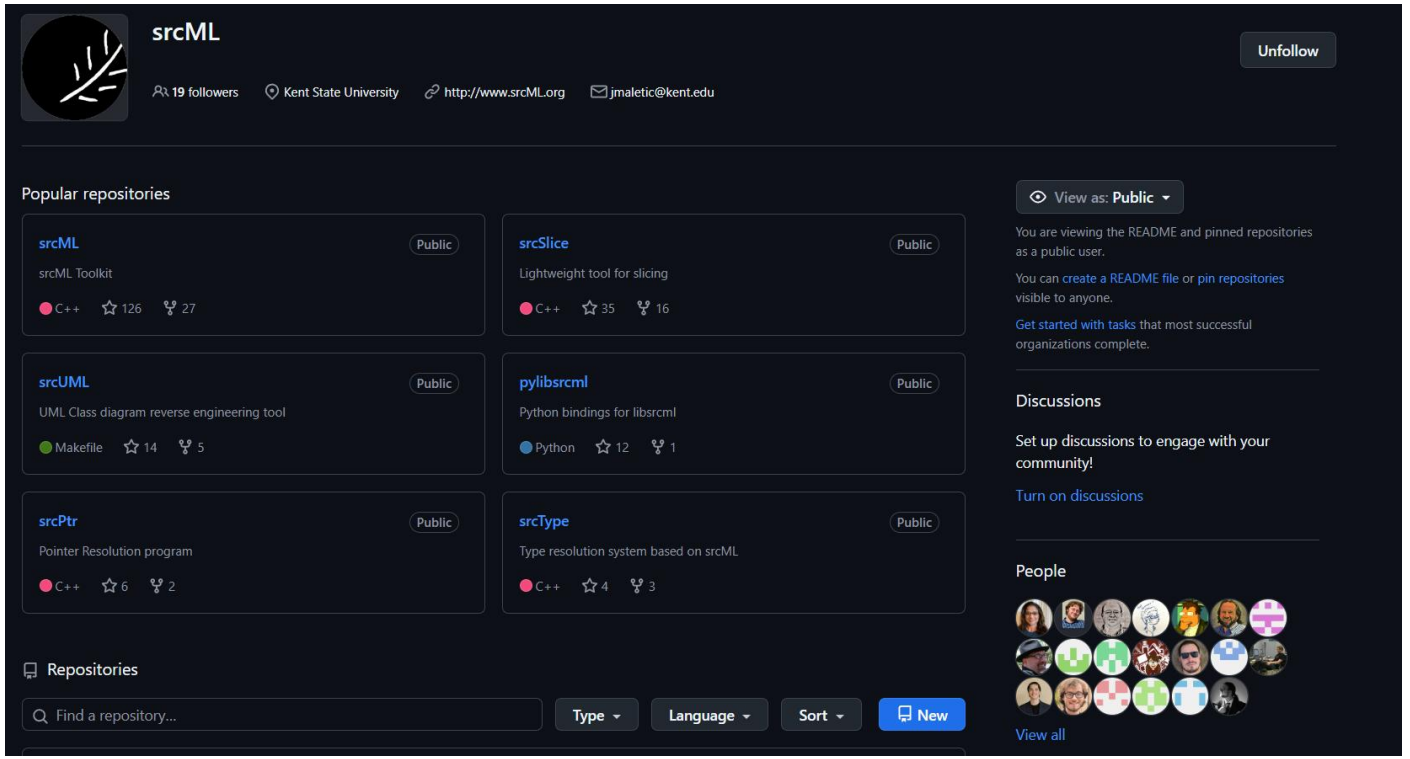
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Benefits of Undergraduate Research

- **Hands-on Experience**: engage in real-world projects
  - Experience that goes beyond classroom learning!
- **Skill Development**: enhance technical and soft skills
  - Learn advanced coding techniques
  - Project management
  - Teamwork by collaborating on research projects with peers and mentors



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Benefits of Undergraduate Research

- **Networking**: connect with researchers, peers, and professionals
  - Attend conferences and workshops to meet industry experts and employers!
- **Career Opportunities**: boost your resume and job prospects
  - Publish your research in top avenues to stand out for grad school or tech jobs!
- Research experience looks great on your resume!



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Software Engineering in Industry

- High demand for software engineer jobs!
- Great salaries!
- Work from (almost) anywhere!
  - Opportunities for remote work and flexible hours
- Opportunity to work in various industries
  - Healthcare, insurance, banking, education, finance, entertainment, automotive, aerospace, and more!
- Ability to innovate, create, and collaborate!
  - Fun Fact: most software is built by teams, not solo coders!

NASA GRC Glenn Research Center

PROGRESSIVE

Cleveland Clinic

ROVISYS Automation & Information Solutions

GOODYEAR

KeyBank

Summa Health

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Getting Started in Software Engineering

- Learn programming (C++, Python, Java)!
- Join coding clubs or hackathons
- Build small projects (websites, games)
- Get involved in opensource projects
- Practice problem-solving (e.g., LeetCode, Codecademy)

- Most of all…
- Be curious!

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Any questions?