Adding Interactive Content to Dive into Systems

A Free, Online Textbook for Introducing Computer Systems

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diveintosystems.org
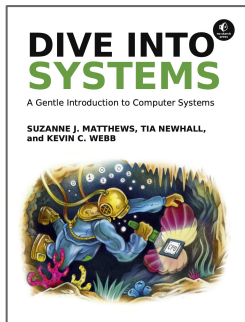
Dive into Systems:

Free, online textbook introducing systems topics and parallel computing, available online at diveintosystems.org

anyone with internet access can use our book!

currently over 40 institutions use our book in their courses

Also low-cost print version

- Published by No Starch Press
- For readers who want a print version
- Will always remain free online too!

No Starch Press, September 2022

diveintosystems.org

Content Overview

Introduction to broad set of systems topics

- Assumes only CS1 background of reader
- Minimal chapter dependencies instructors can easily mix & match content to fit their course

Three Main Themes:

1. How a computer runs a program
2. How systems costs affect program performance
3. How to leverage the power of parallel computing

15 chapters (+ introduction, appendicies)

1. C Intro
2. C Depth
3. C Debugging
12. Code Optimization

6. - 10. Assembly

IA32, x86_64, ARM 64

4. Binary Representation
11. Memory Hierarchy
5. Architecture

13. Operating Systems

14. Shared Memory Parallel
15. Other Parallel

History of community help:

External Reviewers of Every Chapter from Experts in our Field (mostly faculty):

- Strengthened content and presentation
- Helped ensure broad applicability of our textbook

2019-20 Early Adopters Program: 18 faculty using beta version in their course(s)

- Feedback on its use in different courses, institutions from faculty and students (see our SIGCSE'21 paper for survey results)
- Helped further refine topic coverage and presentation

We seek your help in our next effort!

- Primary: Adding Interactive Content to Dive into Systems
  - Online format: ideal for adding other types of content to promote student learning
  - Develop interactive exercises for different book topics
  - Ideas for type of interactive content

- Secondary: Developing Instructor Portal Content
  - exercises, programming/lab assignments, links to example curricula using Dive into Systems, …

Adding Interactive Exercises

- **Seeking Exercise Developers from larger CS community**
  - Use the expertise and help from our larger community!
  - Diversity of uses/ideas/school type/participants
  - NSF funding to provide stipends ($1,000) & some travel support

- **3 Year plan for topic groups:**
  - Year 1: 2022-23: C programming (started mid fall semester)
  - Year 1: 2022-23: Assembly programming (start early winter)
  - Year 2: 2023-24: Architecture
  - Year 2: 2023-24: Binary Representation, Memory Hierarchy and Caching
  - Year 3: 2024-25: OS
  - Year 3: 2024-25: Shared Memory Parallel Computing

Participant Role/Goals

Community Expert Exercise Developer Participants, with project lead(s), will:

- Develop interactive exercises for book chapters

- Identify topics and types of interactivity for problems

- Contribute ideas for types of interactivity, tools

- Help with final selection of exercises to go into book chapters (others to instructor portal)

- Help with evaluation of interactive exercises use in your classes

Student Participants at our institutions:

- Develop tools, add online content (implement exercises using tools)

$1K Stipend Recipient Expectations:

- Attend in-person annual meeting in year of support at SIGCSE to present progress (travel stipends will be provided)

- Meet virtually with group several times during the year (~1 per month)
  - developing question topics and type (how interactive)
  - designing specific questions (subtopic foci)
  - plan items to complete before next meeting
  - initial selection of questions from those developed to including in the textbook
  - few larger planning meetings: summer work, prepare for the annual meeting…

- Participate in helping evaluate use of any exercises in classes you teach

Other Ways to Participate:

Non-stipend Exercise Developer Invitees (need to apply to program):

- Invited to participate with Exercise Developer group(s) in all activities
- Possibly some travel support
- Possibly participate as stipend recipient in other years' topics

Contribute to Instructor Portal Content:

- Problems, programming exercises, links, curricula, …

All Contributors will be acknowledged for their work

Interactive Exercise Tool Demos

- Runestone (Brad Miller)

    - Will also be our main interface to both Runestone tools and to other tools we use for interactive exercises

- C Tutor (Philip Guo)

Develop Interactive Tools for other topics

Develop w/students, design using input from exercise developers

- Assembly Visualizer Tool (Newhall, Webb, Matthews)

- Circuit Tool: TODO
  Not full-blown logisim, but change inputs, trace through a given circuit, human draw simple circuit from truth table, gen truth table from simple circuit, …

- CPU Cache Tool: TODO
  Interact with cache, change RW sequence inputs, cache layout/org/size, replacement policies, tool prompts user for what should happen next, …

- Runestone additions: TODO
  "Give me another" similar question functionality

- Other?   We welcome ideas from participants for other interactive tools

Discussion Questions for Today

1. C Intro
2. C Depth
3. C Debugging
12. Code Optimization

6. - 10. Assembly
IA32, x86_64, ARM 64

4. Binary Representation
11. Memory Hierarchy
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13. Operating Systems

14. Shared Memory Parallel
15. Other Parallel

Adding interactive content to Dive into Systems

- What would you find helpful for your students?
- What types of problems do your students struggle with?
- What interactive formats would be useful for students?
- https://docs.google.com/document/d/1dBh-jDIYR44Zi-y6NT6dHyOGoj-_IVLvtruV5ofXpoQ/edit?usp=sharing

Interested in Participating?

- Take Interest Survey: https://forms.gle/sHUnEsjSVWLptrMo8
- Join the *Dive into Systems* mailing list

   (off diveintosystems.org)
- Look for announcements posted to SIGCSE mailing list
  - SIGCSE 2023 Affiliated Event
- Timeline:
  - Year 1: 2022-23: C programming (started mid fall semester)
  - Year 1: 2022-23: Assembly programming (starting early winter, finalists selected early Nov)
  - Year 2: 2023-24: Architecture
  - Year 2: 2023-24: Binary Representation, Memory Hierarchy and Caching
  - Year 3: 2024-25: OS
  - Year 3: 2024-25: Shared Memory Parallel Comp

Thank you!

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