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Computer Science

Fall 2024: CSCI 181RT

Real-Time Systems in the Real World

Lecture 2

Tuesday, August 29, 2024
Edmunds Hall 105
2:45 PM - 4:00 PM

Professor Jennifer DesCombes

Agenda

- Go Backs
- Who's On First
- Discussion on Reading
- Languages - You Want What?

- Assignment
- Look Ahead
- Action Items

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Go Backs

- General?
- Student Questions?
  - What about hardware appeals to you more than software? Vice versa?
  - Favorite restaurant in the village?
  - What's your favorite bakery?
  - Favorite non-academic book?
- Action Item Status
  - AI240827-1: Send syllabus/documentation by 7:00 PM (Tuesday) - OK to Close

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Who is on First? Who is on First.

-1 What is the name of the player on Second Base?____ _____

-2 What City do the players play for? _____ _____

-3 What is the name of the player on Third Base? ____ _____

-4 When Sebastian offers to play catcher for the team, he describes throwing the batter out at first after the batter ___ ____ the ball.

- Communications Between Two People or Groups
- Clarity
- Rephrase

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Discussion on Reading

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Discussion on Reading

Soft real-time is when a system continues to function even if it's unable to execute within an allotted time. If the system has missed its deadline, it will not result in critical consequences. The system can continue to function, though with undesirable lower quality of output.

Hard real-time is when a system will cease to function if a deadline is missed, which can result in catastrophic consequences.

Discussion on Reading

5 CHARACTERISTICS OF AN RTOS

Determinism: Repeating an input will result in the same output.

High performance: RTOS systems are fast and responsive, often executing actions within a small fraction of the time needed by a general OS.

Safety and security: RTOSes are frequently used in critical systems when failures can have catastrophic consequences, such as robotics or flight controllers. To protect those around them, they must have higher security standards and more reliable safety features.

Priority-based scheduling: Priority scheduling means that actions assigned a high priority are executed first, and those with lower priority come after. This means that an RTOS will always execute the most important task.

Small footprint: Versus their hefty general OS counterparts, RTOSs weigh in at just a fraction of the size. For example, Windows 10, with post-install updates, takes up approximately 20 GB. VxWorks®, on the other hand, is approximately 20,000 times smaller, measured in the low single-digit megabytes.

Discussion on Reading

Evaluation Board and Development System

Controller

Languages - You Want What?

- Currently Popular Languages
- Historic Languages
  - Fortran, ALGOL and LISP, COBOL, BASIC (Dartmouth), PASCAL
  - C, C++, C#
- Intellectual Property (IP)
- Development Risk
  - Legacy Projects
  - Legacy Knowledge

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```
PROCEDURE DIVISION.
*> compute num1 times num2 and store result in numc
COMPUTE NUMC = (NUM1 * NUM2).
*> divide numa by numb and store result in res-div
DIVIDE NUMA BY NUMB GIVING RES-DIV.
*> multiply numa by numb storing result in res-mult
MULTIPLY NUMA BY NUMB GIVING RES-MULT.
*> subtract numa from numb store result in res-sub
SUBTRACT NUMA FROM NUMB GIVING RES-SUB.
*> add numa to numb and store result in res-add
ADD NUMA TO NUMB GIVING RES-ADD.
*> the pointer from numa to
MOVE NUMA TO RES-MOV.
*> reinitilize num1
INITIALIZE NUM1.
*> reinitilize num2 but replace numeric data with 12345
INITIALIZE NUM2 REPLACING NUMERIC DATA BY 12345.
DISPLAY "NUMC:"NUMC
```

C Language

C is a general-purpose programming language which features economy of expression, modern control flow and data structures, and a rich set of operations. C is not a “very high level” language, or a “big” one, and is not specialized to any particular area of application. But its absence of restrictions and its generality make it more convenient and effective for many tasks than supposedly more powerful languages.

In our experience, C has proven to be a pleasant, expressive, and versatile language for a wide variety of programs. It is easy to learn, and it wears well as one’s experience it grows.

From “Preface to the First Edition”, *The C Programming Language*, Kernighan and Ritchie.

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Why C for This Course and Labs?

- Useful to Know - Common in Industry
- Legacy Knowledge
- Existing and Consistent Code Appearance
  - Programming Style
  - Comments
- Legacy Projects
- Well Supported

Historical Tidbit

- Hello World

Lab Resources

- Work Smart, Not Hard
- Application Notes
- Code Samples
- In Lab Resources (Me and Your Classmates)

- Hello World

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Assignment - Readings

- Lecture Reading

  Coding From 1849 to 2022: a Guide to The Timeline of Programming Languages
  https://www.computer.org/publications/tech-news/insider-membership-news/timeline-of-programming-languages

  The Development of the C Language
  https://www.bell-labs.com/usr/dmr/www/chist.html

  K&R - Intro through Page 66

- Lab Reading - Ongoing, No New Assignments

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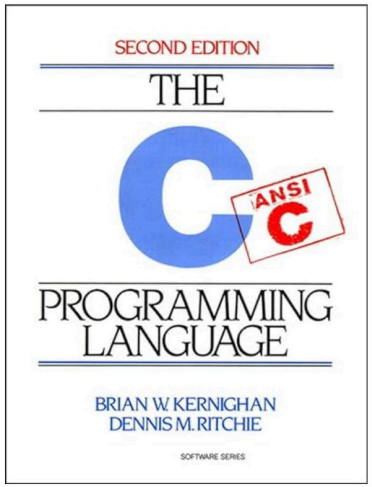
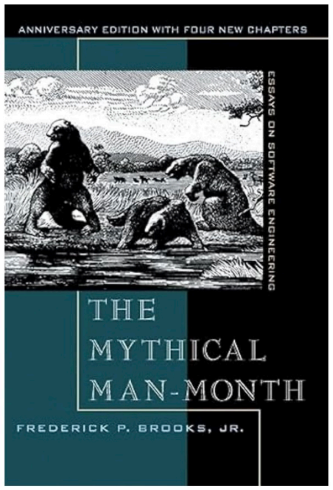
Readings Texts

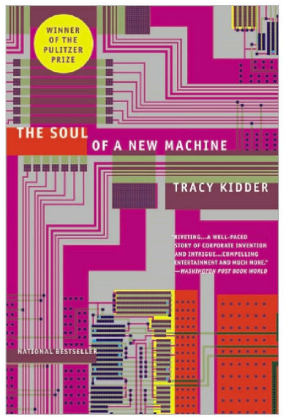
C Programming Language, 2nd Edition 2nd Edition
by Brian W. Kernighan (Author), Dennis M. Ritchie (Author)
Approximately $70 new, $50 Kindle, $40 and lower used.



Mythical Man-Month, The: Essays on Software Engineering, Anniversary Edition
by Frederick Brooks Jr. (Author)
$35 New, $31 Kindle, $30 and lower used.



The Soul of A New Machine
by Tracy Kidde
$20 New



Look Ahead

- Discuss Readings
- Simple Real-time Systems
- Lab Planning - First Design

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Action Items and Discussion

AI#:	Owner	Slide #	Document	Action