

SER 321 B Session

SI Session

Thursday, April 17th 2025

7:00 pm - 8:00 pm MST

Agenda



Rapid Concurrency Structures

Distributed Systems

When to Distribute

Parallel vs. Distributed

Distributed Structures

Consensus

SI Session Expectations

Thanks for coming to the **SER 321** SI session. We have a packed agenda and we are going to try to get through as many of our planned example problems as possible. This session will be recorded and shared with others.

- If after this you want to see additional examples, please visit the drop-in tutoring center.
- We will post the link in the chat now and at the end of the session.
 - tutoring.asu.edu
- Please keep in mind we are recording this session and it will be made available for you to review 24-48 hours after this session concludes.
- Finally, please be respectful to each other during the session.

Interact with us:

Zoom Features



Zoom Chat

- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

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Concurrency Structures

Can we name some concurrency structures?

Atomic Operations &
Variables

Locks

Semaphores

Monitors

Check out the recording for the discussion!

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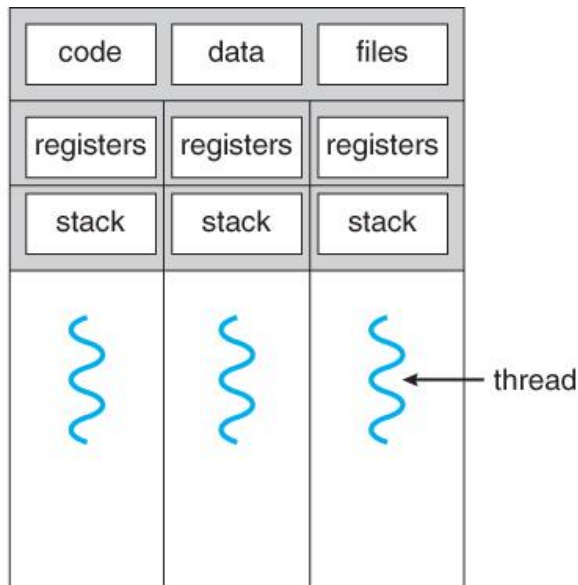
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Concurrency Structures

Atomic Operations & Variables

Recall *registers...*

Ensures updates are immediately visible for the local copy in *each thread*



main:

```
pushq    %rbp
movq     %rsp, %rbp
subq     $48, %rsp
call     __main
movl     $5, -4(%rbp)
movl     $12, -8(%rbp)
movl     -4(%rbp), %eax
addl     $7, %eax
movl     %eax, -12(%rbp)
movl     -8(%rbp), %edx
movl     -12(%rbp), %eax
addl     %edx, %eax
movl     %eax, -16(%rbp)
movl     -16(%rbp), %eax
movl     %eax, %edx
leaq     .LC0(%rip), %rax
movq     %rax, %rcx
call     printf
movl     $0, %eax
addq     $48, %rsp
popq     %rbp
ret
```

Check out the recording for the discussion!

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Concurrency Structures

Pros and Cons?



Locks

Acquire the Lock



Open & Enter

Close & Lock

Release the Lock

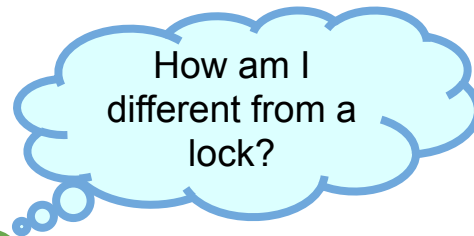


Unlock & Exit

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Concurrency Structures



Semaphores

More
than one
stall!

Acquire Lock



Open & Enter

Close & Lock

Release Lock



Unlock & Exit

Semaphores support
more than one acquirer

When would that be beneficial?



Check out the recording for the discussion!

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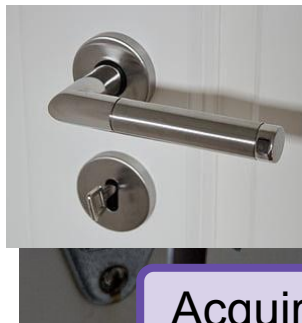
Concurrency Structures

Pros and Cons?

Monitors



You lock
the main
door
instead!



Acquire Lock



Open & Enter

Close & Lock

Release Lock



Unlock & Exit

Covers the
entire object

Check out the recording for the discussion!

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Concurrency Structures

RECAP

Atomic Operations &
Variables

YOU control the
locks directly

Locks

YOU control the
locks directly

Semaphores

YOU control the
locks directly

Monitors

Locks managed
for you

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Concurrency Structures

Monitors

Both *bow()* and *bowBack()* are synchronized → are we good?

Check out the recording for the discussion!

```
PS C:\ASU\SER321\examples_repo\ser321examples\Threads\Deadlock> gradle run
Starting a Gradle Daemon (subsequent builds will be faster)

> Task :run
Alphonse: Gaston has bowed to me!
Gaston: waiting to bow back
Gaston: Alphonse has bowed to me!
Alphonse: waiting to bow back
<=====75% EXECUTING [17s]
> :run
```

Deadlock!

```
public class Deadlock {
    static class Friend { 6 usages
        private final String name; 5 usages
        public Friend(String name) { this.name = name; }
        public String getName() { return this.name; }
        /* See the README.md for a reference on 'synchronized' methods */
        public synchronized void bow(Friend bower) { 2 usages
            System.out.format("%s: %s"
                + " has bowed to me!\n",
                this.name, bower.getName());
            System.out.format("%s: waiting to bow back\n", bower.getName());
            bower.bowBack(bower);
        }
        public synchronized void bowBack(Friend bower) { 1 usage
            System.out.format("%s: waiting", this.name);
            System.out.format("%s: %s"
                + " has bowed back to me!\n",
                this.name, bower.getName());
        }
    }

    public static void main(String[] args) {
        final Friend alphonse =
            new Friend(name: "Alphonse");
        final Friend gaston =
            new Friend(name: "Gaston");
        /* start two threads - both operating on the same objects */
        new Thread(new Runnable() {
            public void run() { alphonse.bow(gaston); }
        }).start();
        new Thread(new Runnable() {
            public void run() { gaston.bow(alphonse); }
        }).start();
    }
}
```

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Concurrency Structures

Monitors
manage locks
for us by
*locking the
entire object*

```
> Task :run
Alphonse: Gaston has bowed to me!
Gaston: waiting to bow back
Gaston: Alphonse has bowed to me!
Alphonse: waiting to bow back
<-----> 75% EXECUTING [17s]
> :run
```

This program demonstrate how a deadlock can be created with synchronized methods:

- <https://docs.oracle.com/javase/tutorial/essential/concurrency/syncmeth.html>
- <https://docs.oracle.com/javase/tutorial/essential/concurrency/locksycn.html>

The key to why it locks can be found in this bullet point from the Tutorial:

- "When a thread invokes a synchronized method, it automatically acquires the intrinsic lock for that method's object and releases it when the method returns. The lock release occurs even if the return was caused by an uncaught exception."

Since both the ``bow()`` and ``bowback()`` method are synchronized methods, they cannot both be called on the same object at the same time, whichever is called first must complete prior to the other executing.

The key to solving this is to use a synchronized statement rather than a synchronized method. With this approach a separate lock object can be shared and keep a deadlock from occurring by not allowing the second bower to start before the first has finished.

A more sophisticated locking scheme can be accomplished with explicit Lock objects and is described here:

Check out the recording for the discussion!

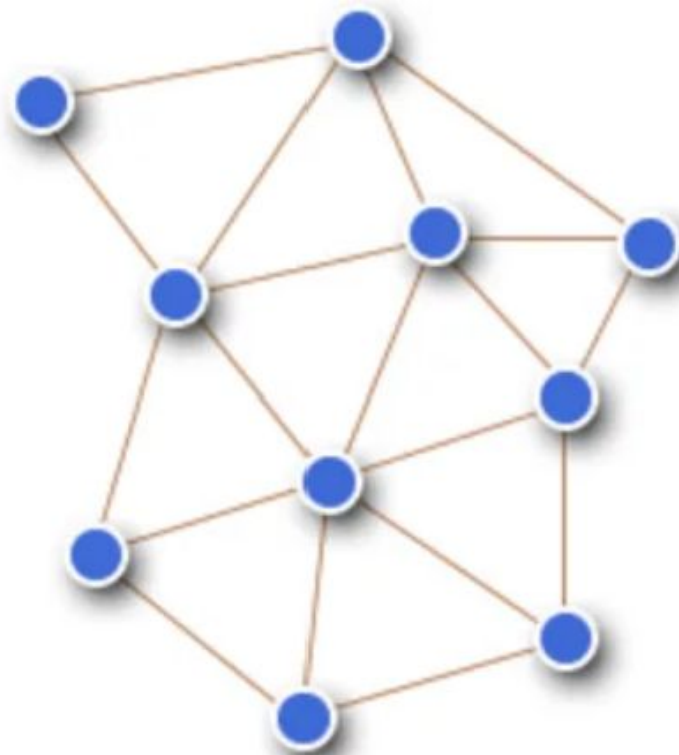
- <https://docs.oracle.com/javase/tutorial/essential/concurrency/newlocks.html>

Check out the recording for the discussion!

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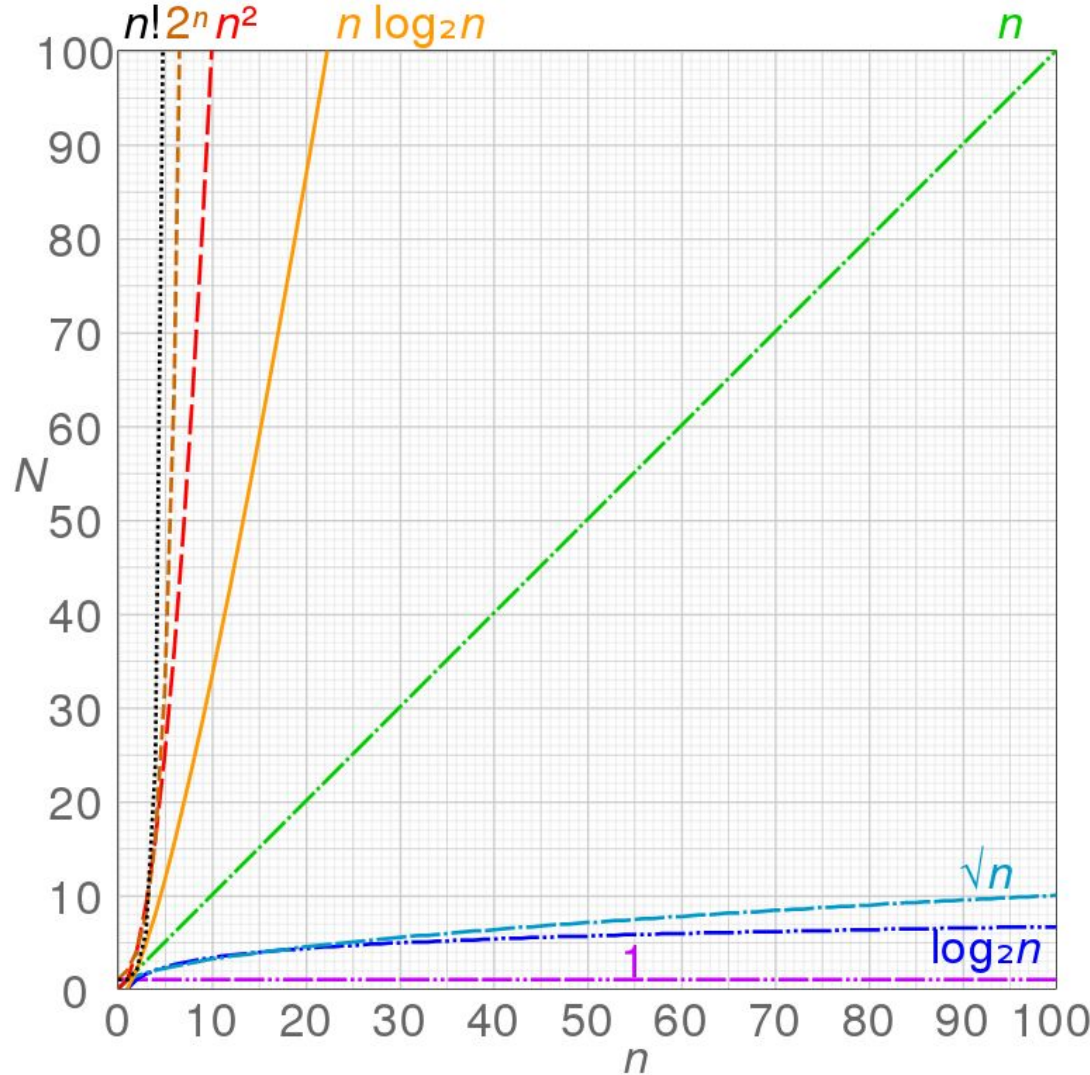
Distributed Systems

What do we mean by
“Distributed Systems”
or
“Distributed Algorithms”?



Distributed Systems

***Check out the recording for
the discussion and
solution!***



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Scratch Space

Upcoming Events

SI Sessions:

- Sunday, April 20th at 7:00 pm MST
- Tuesday, April 22nd at 10:00 am MST
- Thursday, April 24th at 7:00 pm MST

Review Sessions:

- Sunday, April 27th at **6:00 pm MST - 2 hour Exam Review Session**
- Tuesday, April 29th, at 10:00 am MST - **Q&A Session**

Questions?

Survey:

<https://asuasn.info/ASNSurvey>



More Questions?

Check out our other resources!

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[Access the drop-in queue](#)

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tutoring.asu.edu/online-study-hub

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Individual courses have an online peer community that allows you to connect with your peers to post and answer questions and to develop study groups.



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Business

ACC 231

Uses of Accounting Info I

 [Peer Community](#)

ACC 241

Uses of Accounting Info II

 [Peer Community](#)

CIS 105

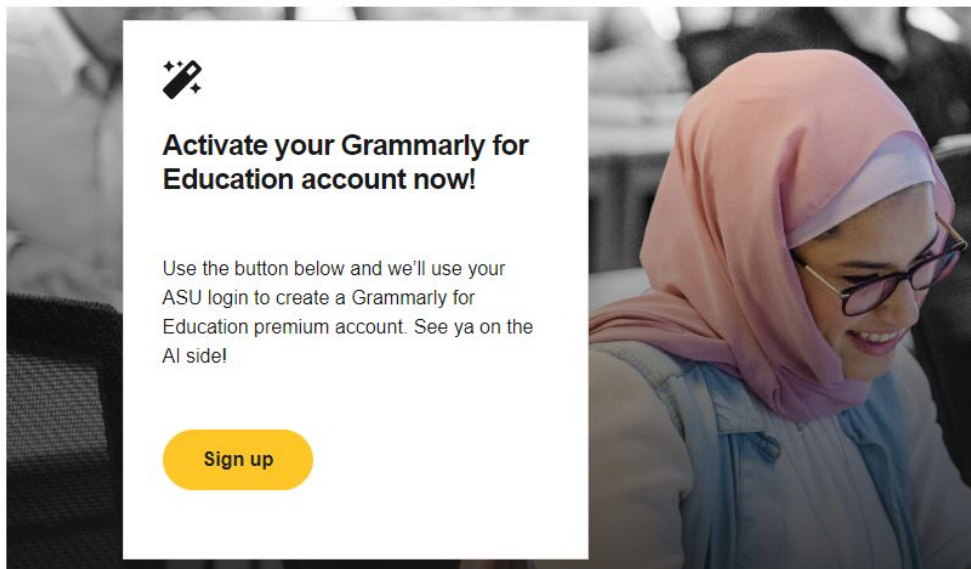
Computer Applications and Information Technology

 [Peer Community](#)

Don't forget to check out the Online Study Hub for additional resources!

Expanded Writing Support Available

Including Grammarly for Education, at no cost!



tutoring.asu.edu/expanded-writing-support

*Available slots for this pilot are limited

Additional Resources

- [Course Repo](#)
- [Gradle Documentation](#)
- [GitHub SSH Help](#)
- [Linux Man Pages](#)
- [OSI Interactive](#)
- [MDN HTTP Docs](#)
 - [Requests](#)
 - [Responses](#)
- [JSON Guide](#)
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