

SER 321 A Session

SI Session

Sunday, September 10th 2023

6:00 - 7:00 pm MST

Agenda



Session Expectations

Gradle Review

Threading

Threading Pitfalls

Synchronization

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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Gradle Review

build.gradle from Assign 4 Act 1
starter code

```
▶ task runServer(type: JavaExec) {  
    group 'server'  
    description 'Creates Server socket waits for messages'  
  
    classpath = sourceSets.main.runtimeClasspath  
  
    main = 'taskone.Server'  
    standardInput = System.in  
  
    if (project.hasProperty('port')) {  
        | args(project.getProperty('port'));  
    }  
}
```

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Gradle Review

build.gradle from Assign 4 Act 1
starter code

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Gradle Review

build.gradle from Assign 4 Act 1
starter code

Can we do this?

```
gradle runServer
```

```
task runServer(type: JavaExec) {  
    group 'server'  
    description 'Creates Server socket waits for messages'  
  
    classpath = sourceSets.main.runtimeClasspath  
  
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    if (project.hasProperty('port')) {  
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Gradle Review

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starter code

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task runServer(type: JavaExec) {  
    group 'server'  
    description 'Creates Server socket waits for messages'  
  
    classpath = sourceSets.main.runtimeClasspath  
  
    main = 'taskone.Server'  
    standardInput = System.in  
  
    if (project.hasProperty('port')) {  
        args(project.getProperty('port'));  
    }  
}
```

```
gradle runServer
```

> Task :runServer FAILED

Usage: gradle runServer -Pport=9099 -q --console=plain

Which ones correctly set the default arguments?

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Gradle Review

A

```
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
}  
args 8000;
```

B

```
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
} else {  
    args 8000;  
}
```

C

```
args 8000;  
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
}
```

D. NONE

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Gradle Review

Which ones correctly set the default arguments?

A

```
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
}  
args 8000;
```

C

```
args 8000;  
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
}
```

B

```
if (project.hasProperty('port')) {  
    args(project.getProperty('port'));  
} else {  
    args 8000;  
}
```

D. NONE

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Threading

Things to remember:

- Threads *share* resources of the parent process - including memory!
- *Less* protection than processes
- Allows for greater responsiveness
- Complex to debug

But hope is not lost!

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Socket Server - No Threads

Make Socket

Wait for connections

Handle the connection

Perform the task

Clean up - what is that again?

`in.close();`

`out.close();`

`sock.close();`

```
public static void main (String args[]) {  
    Socket sock;  
    try {  
        //open socket  
        ServerSocket serv = new ServerSocket( port 8888); // create server socket on port 8888  
        System.out.println("Server ready for 3 connections");  
        // only does three connections then closes  
        // NOTE: SINGLE-THREADED, only one connection at a time  
        for (int rep = 0; rep < 3; rep++){  
            System.out.println("Server waiting for a connection");  
            sock = serv.accept(); // blocking wait  
            // setup the object reading channel  
            ObjectInputStream in = new ObjectInputStream(sock.getInputStream());  
  
            // read in one object, the message. we know a string was written only by knowing what the client sent.  
            // must cast the object from Object to desired type to be useful  
            String s = (String) in.readObject();  
            System.out.println("Received the String "+s);  
            // read in the number, we know it's an integer because that's the second thing sent by the client.  
            Integer i = (Integer) in.readObject();  
            System.out.println("Received the Integer "+ i);  
  
            // generate an output  
            // get output channel  
            OutputStream out = sock.getOutputStream();  
            // create an object output writer (Java only)  
            ObjectOutputStream os = new ObjectOutputStream(out);  
            // write the whole message  
            os.writeObject("Got it!");  
            // make sure it wrote and doesn't get cached in a buffer  
            os.flush();  
        }  
    } catch (Exception e) {e.printStackTrace();}  
}
```

[SockServer](#) from [JavaSimpleSock2](#) in [examples Repo](#)

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Threading your Server

Make Socket

Wait for connections

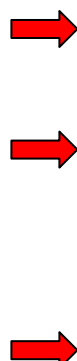
Start Thread

Handle the connection

Perform the task


Clean up

JavaThreadedSock in Sockets



```
ServerSocket serv = new ServerSocket(portNo);
while (true) {
    System.out.println("Threaded server waiting for connects on port " + portNo);
    sock = serv.accept();
    System.out.println("Threaded server connected to client-" + id);
    // create thread
    ThreadedSockServer myServerThread = new ThreadedSockServer(sock, id++);
    // run thread and don't care about managing it
    myServerThread.start();
}
```

```
public ThreadedSockServer(Socket sock, int id) {
    this.conn = sock;
    this.id = id;
}
```



```
public void run() {
    try {
        // setup read/write channels for connection
        ObjectInputStream in = new ObjectInputStream(conn.getInputStream());
        ObjectOutputStream out = new ObjectOutputStream(conn.getOutputStream());

        // read the digit being send
        String s = (String) in.readObject();
    }
}
```

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Threading

Make Socket

Wait for connections

Start Thread

Handle the connection

Perform the task

Clean up

```
in.close();  
out.close();  
conn.close();
```

```
int index;  
// while client hasn't ended  
while (!s.equals("end")) {  
    Boolean validInput = true;  
  
    // checks if input only contains digits  
    if (!s.matches(expr: "\\d+")) {  
        validInput = false;  
        out.writeObject("Not a number: https://gph.is/2vDymkn");  
    }  
  
    // if it contains only numbers  
    if (validInput) {  
        // convert to an integer  
        index = Integer.valueOf(s);  
        System.out.println("From client " + id + " get string " + index);  
        if (index > -1 & index < buf.length) {  
            // if valid, pull the line from the buffer array above and write it to socket  
            out.writeObject(buf[index]);  
        } else if (index == 5) {  
            // fun surprise for mostly correct  
            out.writeObject("Close but out of range: https://youtu.be/dQw4w9WgXcQ");  
        } else {  
            // really wrong  
            out.writeObject("index out of range");  
        }  
    }  
  
    // wait for next token from the user  
    s = (String) in.readObject();  
}
```

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Threading Pitfalls

- Race Condition
- Starvation
- Deadlock
- One thread is only able to acquire access to part its resources
- One thread never gets access to the resource it needs
- More than one thread accesses a single resource at one time

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Threading Pitfalls

- Race Condition

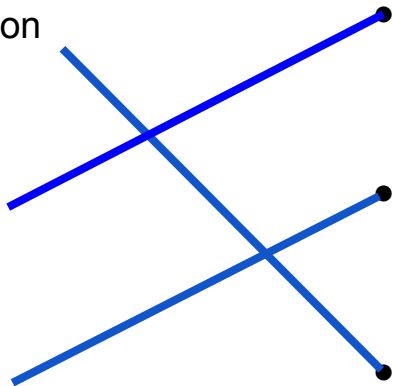
One thread never gets access to the resource it needs

- Starvation

One thread is only able to acquire access to part of its resources

- Deadlock

More than one thread accesses a single resource at one time



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Synchronization

- Locks
- Synchronization

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Synchronization

- Locks
- Synchronization

```
public LockThread (int id, Lock mutex, int sd, int lc) {  
    this.id = id;  
    this.mutex = mutex;           mutex.lock();  
    this.loopCount = lc;          Danger zone  
    this.sleepDelay = sd;         mutex.unlock();  
}
```

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Synchronization

- Locks
- Synchronization

```
public LockThread (int id, Lock mutex, int sd, int lc) {  
    this.id = id;  
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    this.sleepDelay = sd;         mutex.unlock();  
}
```

Locks

```
public synchronized void bow(Friend bower) {
```

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Synchronization and Deadlocks

This is Deadlock from the examples repo

Bow and BowBack are both synchronized

What happens when we run this as is?

```
public class Deadlock {
    static class Friend {
        private final String name;
        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) {
            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(this);
        }
        public synchronized void bowBack(Friend bower) {
            System.out.format("%s: waiting\n", 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("Alphonse");
        final Friend gaston =
            new Friend("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(alfonse); }
        }).start();
    }
}
```

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Synchronization and Deadlocks

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            System.out.format("%s: %s"  
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                    this.name, bower.getName());  
            System.out.format("%s: waiting to bow back\n", bower.getName());  
            bower.bowBack(this);  
        }  
        public synchronized void bowBack(Friend bower) {  
            System.out.format("%s: waiting\n", 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("Alphonse");  
        final Friend gaston =  
            new Friend("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();  
    }  
}
```

```
Deadlock [Deadlock.main()] x  
Deadlock [Deadlock.main()]: Running 8 sec 9:44:55 PM: Executing ':Deadlock.main()'...  
Deadlock.main() 8 sec  
Task :compileJava  
Task :processResources NO-SOURCE  
Task :classes  
Task :Deadlock.main()  
Alphonse: Gaston has bowed to me!  
Gaston: waiting to bow back  
Gaston: Alphonse has bowed to me!  
Alphonse: waiting to bow back  
|
```

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Synchronization and Deadlocks

This is Deadlock from the examples repo

Synchronizing **methods** is not always the
best solution

How do we fix it?

```
public class Deadlock {  
    static class Friend {  
        private final String name;  
        public Friend(String name) {  
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        }  
        public String getName() {  
            return this.name;  
        }  
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            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(this);  
        }  
        public synchronized void bowBack(Friend bower) {  
            System.out.format("%s: waiting\n", 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("Alphonse");  
        final Friend gaston =  
            new Friend("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(alfonse); }  
        }).start();  
    }  
}
```

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Synchronization and Deadlocks

This is Deadlock from the examples repo

Synchronizing **methods** is not always the
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How do we fix it?

Can remove the synchronized keyword, but
that would allow a race condition...

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public class Deadlock {  
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        private final String name;  
        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) {  
            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(this);  
        }  
        public synchronized void bowBack(Friend bower) {  
            System.out.format("%s: waiting\n", 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("Alphonse");  
        final Friend gaston =  
            new Friend("Gaston");  
        /* start two threads - both operating on the same objects */  
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            public void run() { alphonse.bow(gaston); }  
        }).start();  
        new Thread(new Runnable() {  
            public void run() { gaston.bow(alfonse); }  
        }).start();  
    }  
}
```

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Synchronization and Deadlocks

This is Deadlock from the examples repo

Synchronizing **methods** is not always the
best solution

How do we fix it?

Synchronized *statement* allows us to

synchronize without attempting to call

two synchronized methods on the same

object

```
public class Deadlock {
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        }
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            return this.name;
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        /* See the README.md for a reference on 'synchronized' methods */
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                this.name, bower.getName());
            System.out.format("%s: waiting to bow back\n", bower.getName());
            bower.bowBack(this);
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    }
}
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Synchronization and Deadlocks

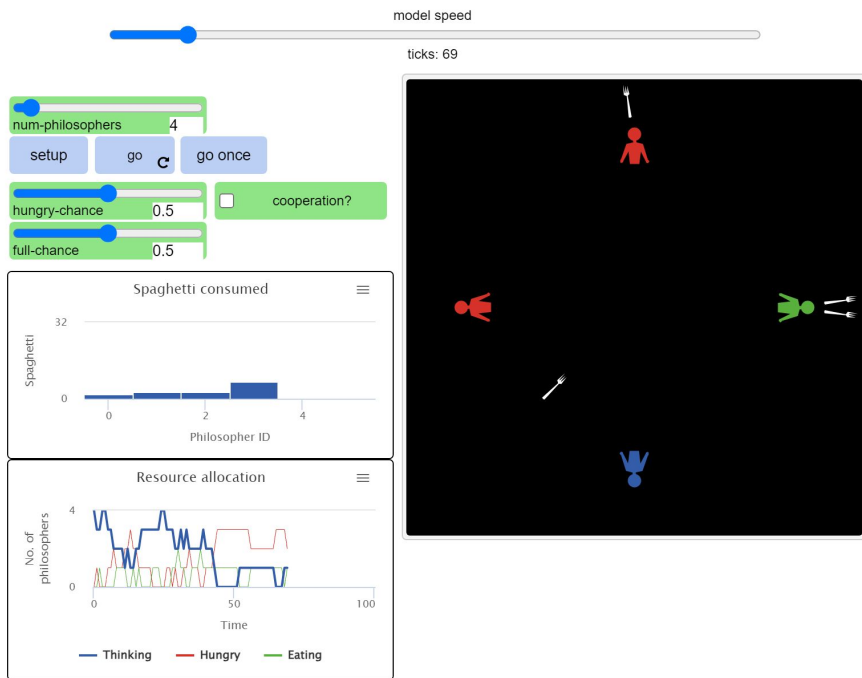
```
> Task :Deadlock.main()
Alphonse: Gaston has bowed to me!
Gaston: waiting to bow back
Gaston: waiting
Gaston: Alphonse has bowed back to me!
Gaston: Alphonse has bowed to me!
Alphonse: waiting to bow back
Alphonse: waiting
Alphonse: Gaston has bowed back to me!
```

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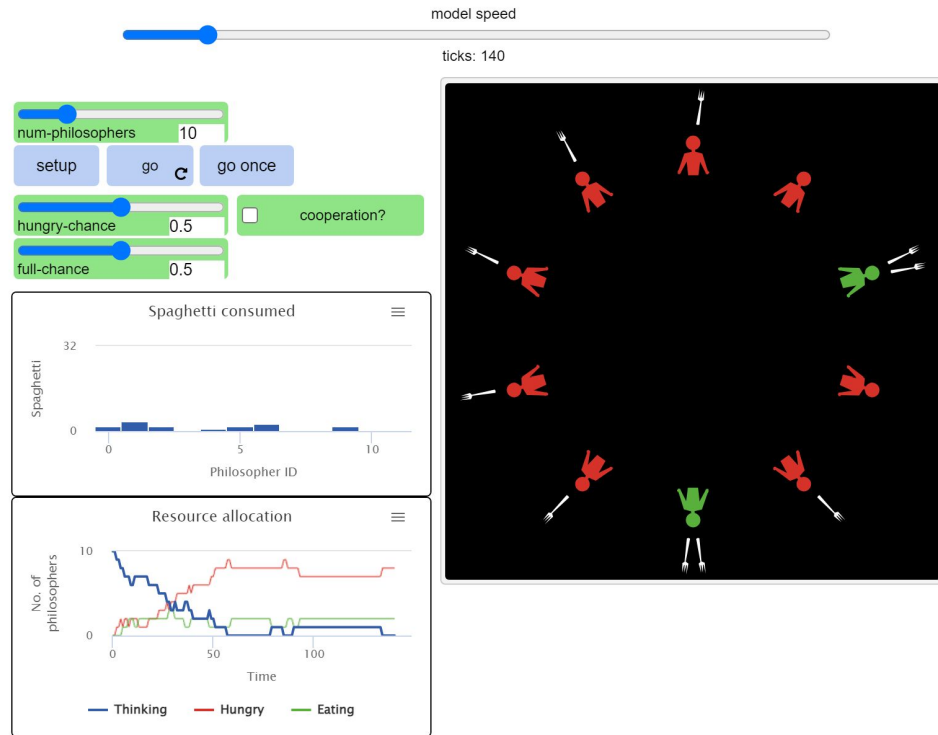
```
public void bow(Friend bower) {
    System.out.format("%s: %s"
        + " has bowed to me!\n",
        this.name, bower.getName());
    System.out.format("%s: waiting to bow back\n", bower.getName());
    synchronized(this) {
        bower.bowBack(this);
    }
}
```

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Remember Dining Philosophers?



Interactive



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Tomorrow's Agenda

- More Thread Review
 - Anything we didn't cover today
 - More on Race Conditions?
- Review Serialization
- Review Protobufs
- Review Assignment 4 Activity 1

Have a request? Post here or in the si-channel on slack and I'll be sure to spend some extra time on it tomorrow!

Questions?

Survey:

https://bit.ly/asn_survey



Upcoming Events

SI Sessions:

- Tomorrow Monday September 11th, 6:00 pm MST

Review Sessions:

- TBD

More Questions?

Check out our other resources!

tutoring.asu.edu



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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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How does the Tutorbot work?

You can ask the Tutorbot questions about course concepts and the Tutorbot will recommend additional resources and examples to help address your questions.

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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!

Additional Resources

<https://ccl.northwestern.edu/netlogo/models/DiningPhilosophers>

[Examples Repo](#)