SER 321 A Session

SI Session

Monday, September 18th 2023

6:00 - 7:00 pm MST

Agenda

- Threading Mini-Quiz
- Thread Review
- Assignment Structure
- Running your Assignment

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

SER 321
Thread Review

Which of the following correctly enables the Client to start a thread?

A.

```
public class Client implements Thread{
```

B.

```
public class Client makes Thread{
```

C.

```
public class Client extends Thread{
```

D.

```
public class Client permits Thread{
```

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Thread Review

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SER 321
Thread Review

```
client.start();
```

The code above starts which of the following methods?

A.

```
public void start() {
```

B.

```
public void run() {
```

C.

```
public void thread() {
```

D.

```
public void execute() {
```

SER 321
Thread Review

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public void execute() {
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Thread Review

```
//create threaded server
ThreadedServer threadedServer = new ThreadedServer(                    );
//send off to work
threadedServer.start();
```

Which of the following constructors correctly initializes a ThreadedServer allowing the code above to function?

A.

```
public ThreadedServer(Socket sock) {
    this.conn = sock;
}
```

B.

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

C.

```
public ThreadedServer(int id) {
    this.id = id;
}
```

D.

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

SER 321
Thread Review

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}
```

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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/2yDymkn");
  }

  // 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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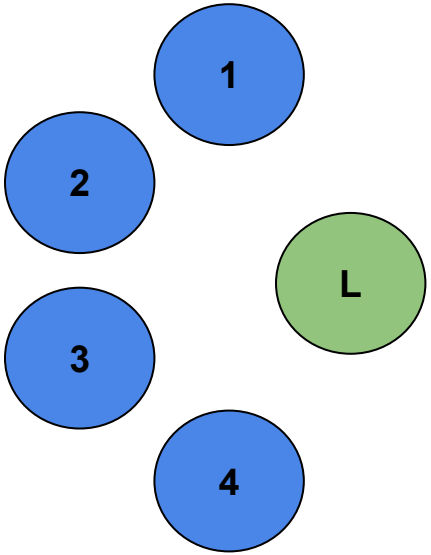
Assignment Structure

Leader with worker nodes



Theoretically each node is a different computer connected to the system scattered over the globe.

We are going to use threads to simulate

Each node receives a portion of the data to perform a task for/on

We are encrypting strings to simulate

Once complete, each node reports back to the leader with the result

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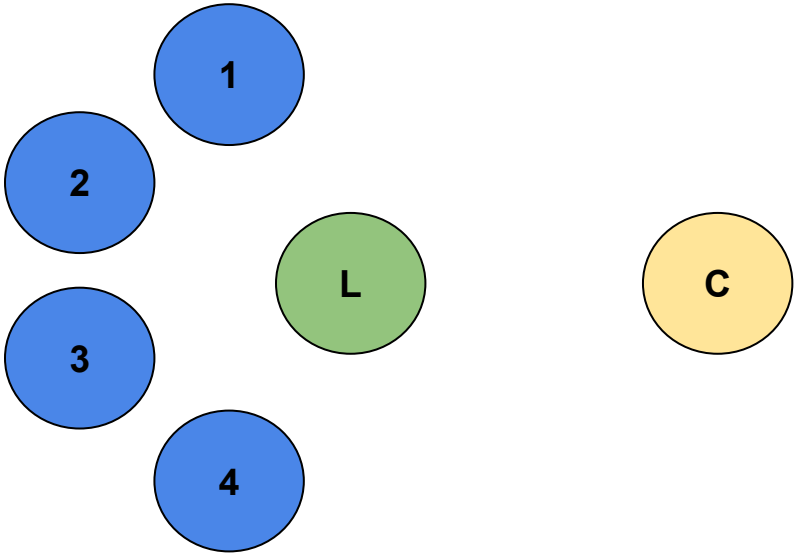
Assignment Structure

Leader with worker nodes



The leader is responsible for everything

- Data
- Partitioning data
- Nodes
- New nodes
- Unresponsive nodes
- Faulty nodes
- Node responses
- Client communication

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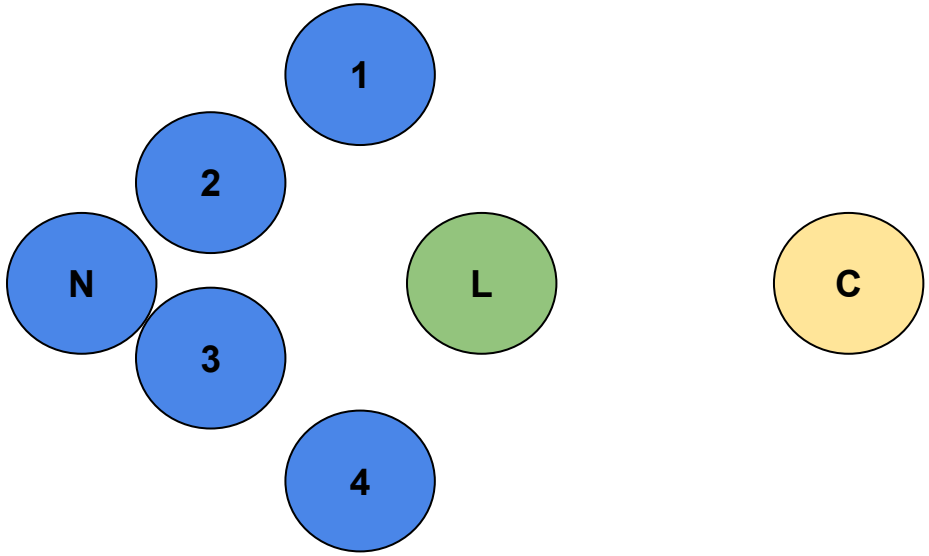
Assignment Structure

Leader with worker nodes

All nodes are identical

Really only need three classes then

- Client
- Leader
- Node



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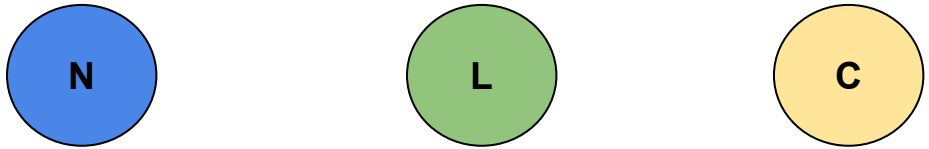
Assignment Structure

Leader with worker nodes



Need at least three nodes at all times

What if you drop below three?

Send error message to client - graceful!

Need a set max limit for nodes (8)

Nodes are threaded!

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Assignment Structure

Client will communicate with leader
then backs off to wait

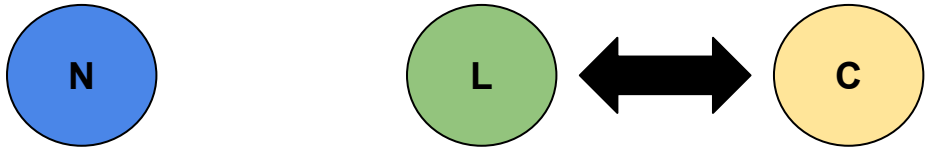
Connection is established

Leader prompts client for a sentence

Client sends sentence

Leader *does work*

Leader sends client the encrypted sentence



Think about the protocol you want to use!

JSON or Protobuf?

Start getting a rough outline together

Two “Areas” to cover
- Leader-Client communication
- Leader-Node communication

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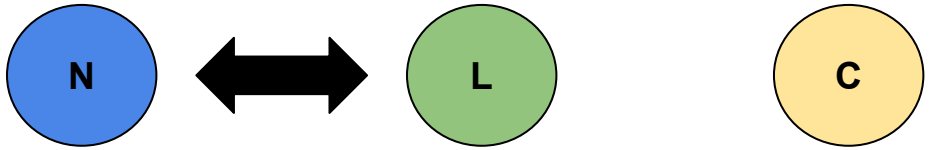
Assignment Structure

What does the node have to do?



Task 1:
- Receive data
- Encrypt data
- Return data

Task 2:
- Receive data
- Encrypt data
- **Check data**
- Return result

Both Encrypt steps should **use the same method**

Could have an error in one method and not the other

How could we handle this elegantly?

Think in terms of protocol!

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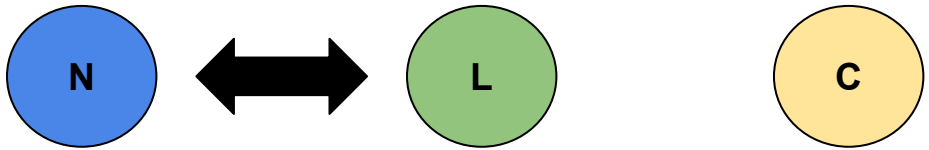
Assignment Structure

Leader *does work*



Overview of Leader's job

- Split the data up for each node
- Send NodeData to each node
- Wait for response
- Receive encrypted data
- Start Consensus
    - Send NodeData and encrypted NodeData to a *new* node
    - Check response
        - If no - previous node was faulty
        - Else continue
    - Once all encryptions have been checked by a second node, continue
- Reassemble data
- Return data to client

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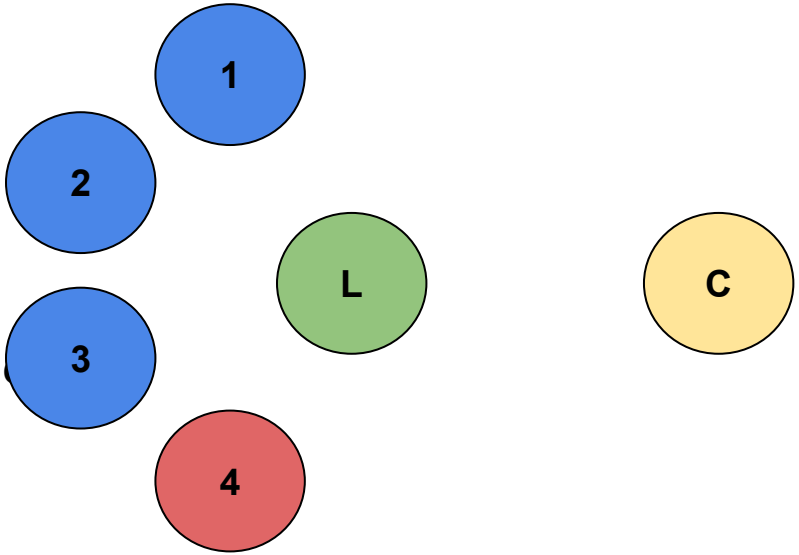
Running your Assignment

Then start at least 3 nodes

First start your lead

You can make a node faulty with the Fault flag

Then start your client



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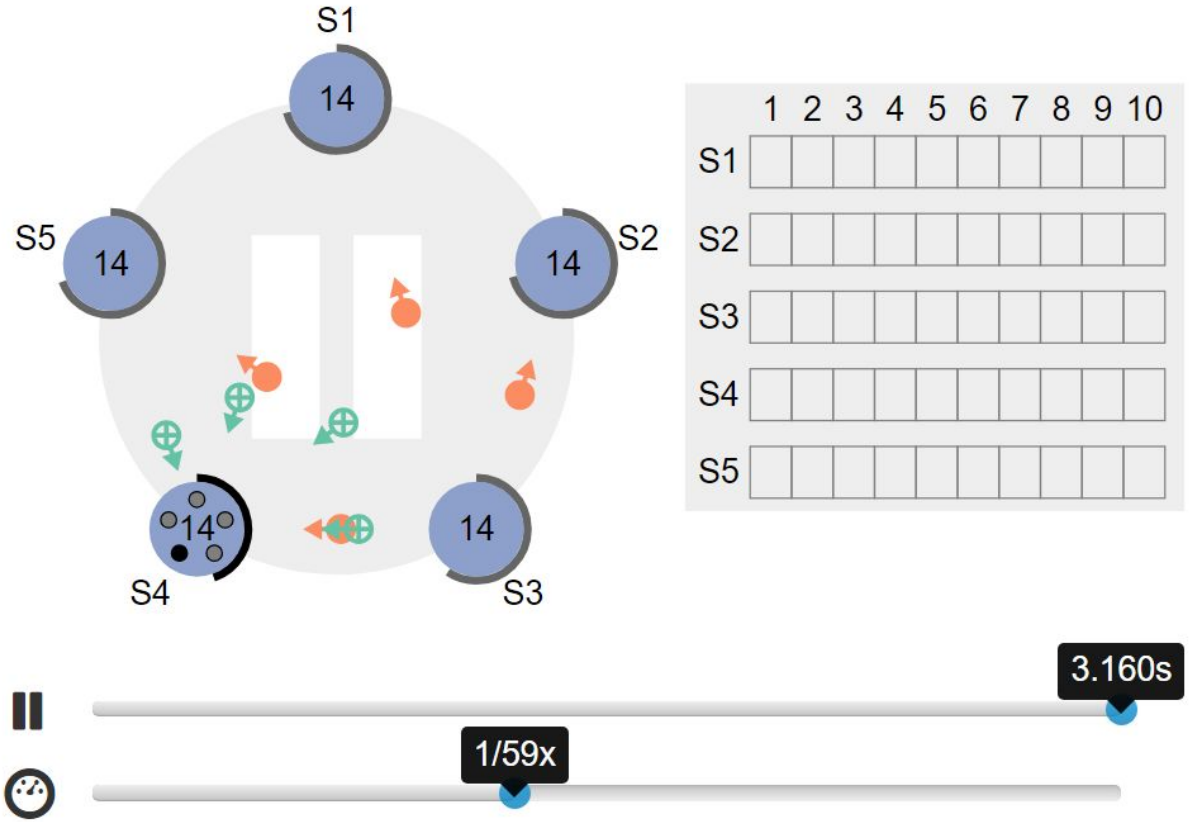
RAFT

RAFT



Questions?

Survey:

https://bit.ly/asn_survey

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Upcoming Events

SI Sessions:

- Wednesday September 20th 2023 6:00 pm MST

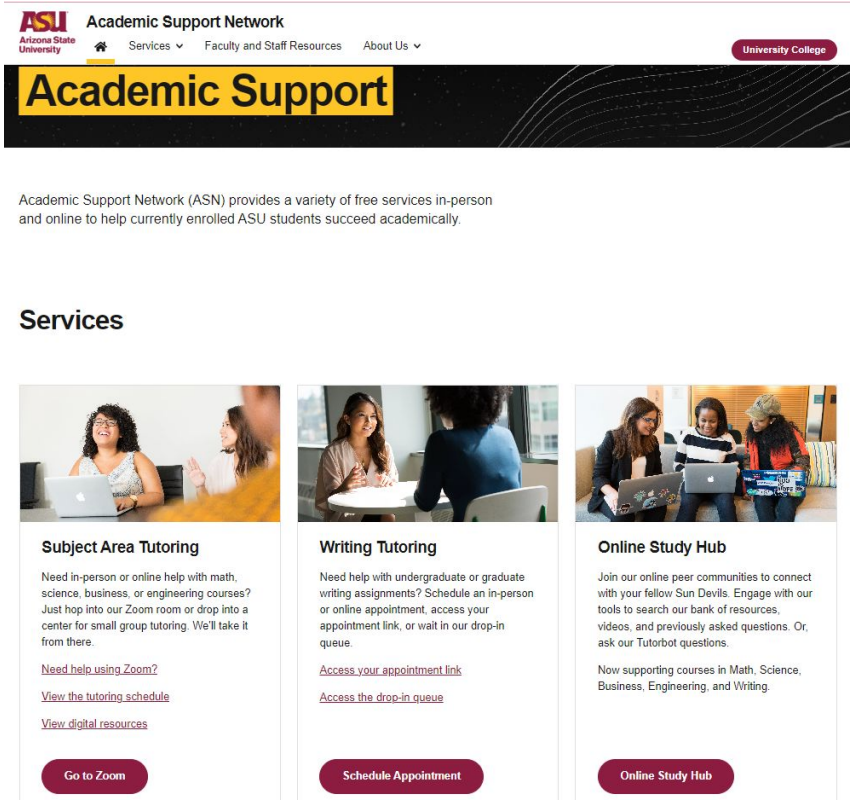
Review Sessions:

- TBD

More Questions?

Check out our other resources!

tutoring.asu.edu

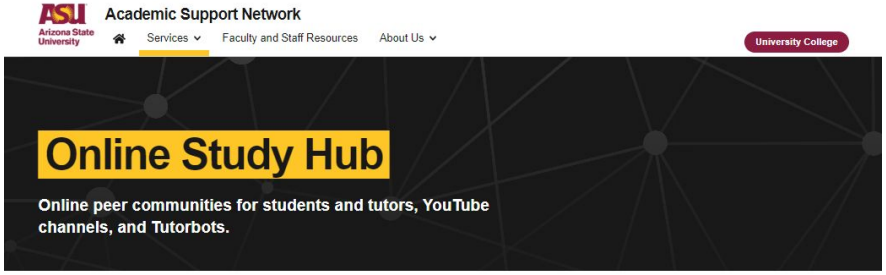


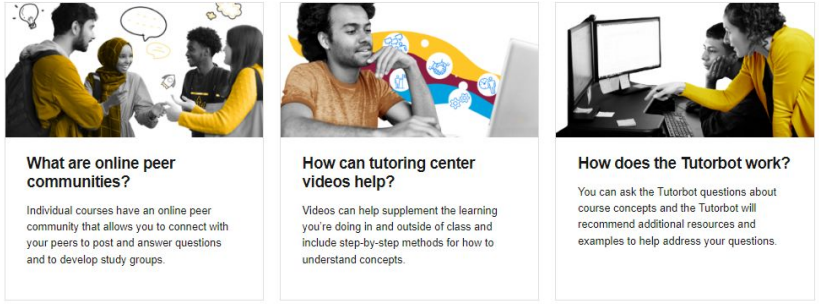
1. **Click on ‘Go to Zoom’ to log onto our Online Tutoring Center.**
2. **Click on ‘View the tutoring schedule’ to see when tutors are available for specific courses.**

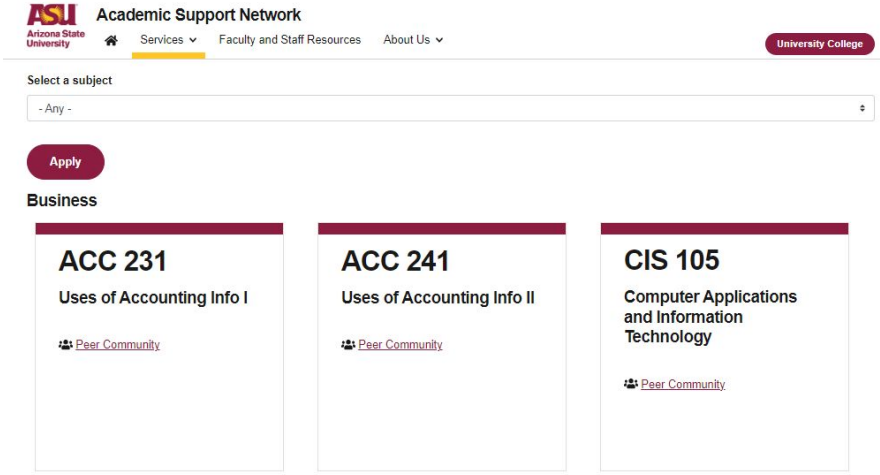
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub







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

Additional Resources

RAFT

Examples Repo

- SimplePeerToPeer