SSCI 581 (Section 35693), Concepts for Spatial Thinking

Syllabus

Units: 4

Term — Day — Time: Fall 2017, Online

Location: Online

Instructor: Katsuhiko “Kirk” Oda, PhD GISP
Office: AHF B56B
Regular Office Hours: Mon 11 am-12 pm PT and Wed 2-3 pm PT Also available most days and times by appointment via email.

Contact Info: katsuhio@usc.edu, 213-740-2868 (office), https://bluejeans.com/2137402868

Library Help: Sherry Mosley
Office: VKC B40C
Office Hours: By appointment
Contact Info: smosley@usc.edu, 213-740-8810 (office)

IT Help: Richard Tsung
Office: AHF 146
Office Hours: By appointment
Contact Info: ctsung@usc.edu, 213-821-4415 (office)
Course Scope and Purpose

This course is designed as an introduction to geographic information science, and more importantly, to the cartographic and spatial concepts underlying spatial thinking and the associated geospatial technologies.

In addition, the course, by both necessity and design, serves several different audiences given its role as a required entrée course for four online programs – the GIST M.S. and Graduate Certificate programs, the Geospatial Intelligence Graduate Certificate, and the GeoHealth track in the Keck School of Medicine’s Master of Public Health program – and one residential program, the M.S. in Spatial Informatics. The different student clientele is provided with a variety of options in several of the major assignments so they can align the geospatial data, analysis, and visualization tasks tackled in these assignments with their own interests and aspirations.

Looking beyond these specific audiences, this is also a good course for those who simply wish to improve their GIS skills and for those who want to understand the underlying concepts. In this course, you will gain an understanding of the fundamentals of geographic information science, including geodesy, the evolving role of maps in science, policy and our everyday lives, and the ways in which various forms of spatial analysis, modeling and visualization can be performed using Esri’s ArcGIS ecosystem.

Spatial thinking – We will start by exploring why spatial thinking is important for describing, analyzing, modeling and visualizing our world and how the "habit" of spatial thinking can be encouraged and cultivated among working professionals, citizens and most of all, students of all ages. We will use a series of readings and case studies to show how spatial thinking permeates and supports various kinds of problem solving.

Geodesy – We will next turn our attention to geodesy, which is the branch of science concerned with the size and shape of the Earth and determining what is where on its surface. The major topics to be covered – geodetic datums, geoids, coordinate systems, and map projections – are fundamental building blocks for all that follows in our programs and of course, in the successful deployment and use of geospatial technologies.

Fundamentals of GIS – We will explore the evolving field of geographic information science and the relationships between this and other disciplines across the natural and social sciences, the humanities, engineering, and the applied sciences, and the professions (architecture, health, journalism, and social work, among others).

The ArcGIS Ecosystem – We will explore how the ArcGIS software ecosystem can be used to represent and analyze the world around us through a series of tutorials that cover different types of geospatial data, raster and vector data models, coordinate systems and map projections, and selected forms of geographic analysis, including geoprocessing and raster analysis.

Maps – Maps have been used for hundreds and possibly thousands of years to compile and communicate geographic concepts and relationships. Once the more or less exclusive domain of professional cartographers, maps can be authored and shared in new and wonderful ways
using GIS and the internet. We will review past, present, and future map use and how maps can depict and communicate geographic knowledge in a digital age.

*Spatial Data Discovery* – Data is an essential component of GIS. We will explore core geospatial datasets and attain knowledge and skills necessary for processing and describing GIS data, including census data.

This is a graduate level course, so you should expect to be intellectually challenged throughout the term. As graduate students you must engage with the course contents and explore their heady cauldron of ideas, opinion, and analysis. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate class, the instructor’s role is that of a guide to lead you on this path of discovery, and you will find that you learn much from your fellow classmates. The challenge for the instructor is to replicate such an academic experience within the milieu of learning in a digital era.

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned readings. Written assignments will give students an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction. Hands-on practical exercises will mainly use ArcGIS Pro.

**Learning Outcomes**

On completion of this course, students should be able to:

- Explain the role and importance of geodesy and how the various components – geodetic datums, geoids, coordinate systems, and map projections – can be used to position and locate things (i.e. places, people, features) on the Earth’s surface.
- Specify how the various elements of spatial thinking can enable us to identify, describe, analyze, and visualize phenomena.
- Define the fundamental spatial concepts and terms such as arrangement, orientation, diffusion, dispersion, and pattern.
- Explain cartographic excellence and how maps and geographic understanding have been used throughout history to organize and empower different groups of people.
- Speculate on how maps might be used by various people in the next few decades.
- Describe one or more compelling applications of spatial thinking and why these kinds of workflows and/or solutions are important.
- Specify how the spatial analysis, modeling, and visualization tools included in geographic information systems and other geospatial technologies might be used to advance knowledge creation and communication across a variety of disciplines.
- Process, assess, and describe core geospatial datasets including census data.

**Prerequisite(s):** None  
**Co-Requisite(s):** None  
**Recommended Preparation:** None
Technological and Communication Requirements

ArcGIS is provided online via the SSI Server; hence, you do not need to install it on your own computer. Instead, every student must have the following technology requirements:

- Every student must have a computer with a fast Internet connection (DSL at a minimum).
- Every student must have a functional webcam for use whenever a presentation or meeting is scheduled.

SSI Server and Tech Support – This course utilizes the SSI Server which is a virtual desktop giving access to many different professional software. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) your instructor on the email.

Communications – This is a distance learning course, so most of our interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via Blackboard. It is each student's responsibility to stay informed about what is going on in our course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Do not ignore course email until the day before assignments are due. Also double check to be sure that email sent from the USC blackboard account does not go into your junk mail!

While I am often on-line and will respond to emails from students very quickly, I will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be off-line for more than 72 hours, I will post an announcement on the Blackboard site.

Required Readings and Supplementary Materials

Textbooks – There are seven texts for this course. We encourage you to purchase the first and the fourth of these books early since you will need these materials from the opening day of class. Please make sure to obtain the correct editions of the texts. They are available from the USC Bookstore or online outlets such as Amazon. For further information on the Bolstad text, visit the following page: http://www.paulbolstad.net/gisbook.html. Please note that you are not required to buy the other textbooks. A portion of the second, third and fifth texts will be posted on Blackboard. The NRC Report can be downloaded free-of-charge from the web. The Wilson and Fotheringham book is available through the USC Libraries as an e-Book.


The aforementioned textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports and authoritative websites.

Readings – Additional readings that focus on topics relevant to course themes will be provided through Blackboard.


**Description and Assessment of Assignments**

**Weekly Assignments**

There are several different kinds of assignments with at least one due weekly. These are described in the Weekly Folders on Blackboard. Due dates are shown in the summary that follows.

*Resume Assignment – 1 worth 1 point.* We require all current students to post and maintain a public resume, short biography and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template which will be provided to you. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience and professional aspirations.

*Access SSI Server Tutorial – 1 worth 1 point.* The SSI Server will be used frequently throughout the semester. Therefore, you must ensure the access to the server on the first week. To complete the exercise, you will refer to the Access SSI Server document.

*Discussion Forums – 6 worth 12 points.* Students are required to take part in online discussion forums via Blackboard. These will focus on varying combinations of theory and practice. You will post a minimum of six new messages (i.e. one per forum) and 12 replies to messages posted by your classmates (i.e. two per forum) at designated times throughout the semester.

*Written Assignments – 5 worth 15 points.* Each student is required to complete five written assignments for this class. These assignments will focus on the theory portion of the course as presented in weekly readings. The objective is to help you evaluate and integrate the information you have acquired from the course readings. Three of these assignments are required (for more detail, see the course schedule table at the end of this syllabus), and you are free to choose any two from the remaining assignments but you must complete and submit them for grading in the weeks specified in the Course Schedule below. If you complete more than five reading assignments, your instructor will use your highest two scores for the remaining assignments towards your course grade.

*Geodesy Quiz – 1 worth 5 points.* One quiz will be administered towards the end of the geodesy module and will afford each of you the opportunity to demonstrate your knowledge and understanding of geodetic datums, coordinate systems, and map projections.

*ArcGIS Tutorials – 5 worth 15 points.* You will work through Law and Collins’ ArcGIS Pro workbook and selected Esri web courses. To demonstrate that you have completed each tutorial, you will turn in a written report for each. In addition, you will be expected to offer each other advice and assistance on tutorials through Blackboard.
Reading Quizzes – 20 worth 8 points. These are short quizzes based on assigned readings. The questions draw on key topics and support student engagement with the readings.

GIS Data Tutorials – 3 worth 15 points. In this set of three tutorials, study sources of spatial data, collect data, and learn techniques for processing three types of spatial data. You will process U.S. Census data in the first tutorial and other GIS data types such as elevation, hydrography, land cover, and transportation networks in the following tutorials. You will describe properties of your obtained data such as the spatial and temporal granularity, measurement scales, sample designs, and possible applications.

Final Project

The Final Project is your opportunity to integrate all that you have learned in the semester by framing a geospatial question for decision support in a topic of your choosing. You will collect the appropriate spatial and non-spatial data, import the data into ArcGIS, produce and interpret a series of maps that represent geographic phenomena related to your spatial analysis. To help facilitate this work, the workflow is broken up into four distinct components:

Proposal - 6 points. A single paragraph (300-word maximum) that describes a research question and a table summarizing criteria for your spatial analysis. An individual meeting (to be held online) with the instructor to discuss the proposal is also required.

Data Report - 3 points. A report documenting the data you have identified and acquired for your project. ALL data you plan to employ in your analysis should be included.

Final Report - 16 points. A final report of your project, which must not exceed 10-12 single-spaced and typed pages including figures, maps, tables and references.

Final Presentation - 3 points. You will deliver a presentation of your final project and attend the other students’ presentations during our scheduled final exam.

Grading Breakdown

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other SSCI courses. The table below summarizes the SSCI 581 course assignments and their point distribution:
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<tr>
<th>Assessment</th>
<th>Number</th>
<th>Points Each</th>
<th>Total Points</th>
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<td>Resume Assignment</td>
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<td>Access SSI Server Tutorial</td>
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<td>Discussion Forums</td>
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<td>Written Assignments</td>
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<tr>
<td>Geodesy Quiz</td>
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<td>ArcGIS Tutorials</td>
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<td>Reading Quizzes</td>
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<td>GIS Data Tutorials</td>
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<td><strong>Project Components</strong></td>
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<td>Proposal</td>
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<td>Data Report</td>
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<td>Final Report</td>
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<td>Final Presentation</td>
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<td><strong>Total</strong></td>
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**Assignment Submission Policy**

Unless otherwise noted, assignments must be submitted via Blackboard by the due dates specified in the Course Schedule below and on the assignment instructions. Your attention to on-time assignment submission is essential. Your instructor will aim to return comments on your submitted assignments before the next one is due.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

**Course Schedule: A Weekly Breakdown**
| Week 1 8/21 | Introduction | Course Syllabus  
NRC: Ch 1&2  
Resume Assignment  
Access SSI Server Assignment  
Discussion Forum 1  
Reading Quiz 1  
Reading Quiz 2 | No deliverables |
| Week 2 8/28 | Spatial Thinking | NRC: Ch 3  
Downs 1997  
Law: Ch 1&2  
Written Assignment 1 (Required)  
ArcGIS Tutorial 1  
Discussion Forum 2  
Reading Quiz 3  
Reading Quiz 4 | Resume Assignment: Tuesday, 8/29  
Access SSI Server Assignment: Tuesday, 8/29  
Discussion Forum 1 Posts: Tuesday, 8/29  
Reading Quiz 1: Tuesday, 8/29  
Reading Quiz 2: Tuesday, 8/29  
Responses to Discussion Forum 1: Thursday, 8/31 |
| Week 3 9/5*  
*Monday, 9/4 is a university holiday | Spatial Primitives | DeMers: Ch 0&2  
Law: Ch 3&10  
ArcGIS Tutorial 2  
Discussion Forum 3  
Reading Quiz 5  
Reading Quiz 6 | Written Assignment 1: Tuesday, 9/5  
ArcGIS Tutorial 1: Tuesday, 9/5  
Discussion Forum 2 Posts: Tuesday, 9/5  
Reading Quiz 3: Tuesday, 9/5  
Reading Quiz 4: Tuesday, 9/5  
Responses to Discussion Forum 2: Thursday, 9/7 |
| Week 4 9/11 | Geodesy and Datums | Bolstad: Ch 3  
Law: Ch 5&7  
ArcGIS Tutorial 3  
Reading Quiz 7  
Reading Quiz 8 | ArcGIS Tutorial 2: Tuesday, 9/12  
Discussion Forum 3 Posts: Tuesday, 9/12  
Reading Quiz 5: Tuesday, 9/12  
Reading Quiz 6: Tuesday, 9/12  
Responses to Discussion Forum 3: Thursday, 9/14 |
| Week 5 9/18 | **Coordinate Systems** | Bolstad: Ch 3  
Law: Ch 9  
ArcGIS Tutorial 4  
Reading Quiz 9  
Reading Quiz 10 | ArcGIS Tutorial 3: Tuesday, 9/19  
Reading Quiz 7: Tuesday, 9/19  
Reading Quiz 8: Tuesday, 9/19 |
|---|---|---|---|
| Week 6 9/25 | **Map Projections** | Bolstad: Ch 3  
Cebrecos 2016  
Geodesy Quiz  
Written Assignment 2 (Elective)  
ArcGIS Tutorial 5  
Reading Quiz 11 | ArcGIS Tutorial 4: Tuesday, 9/26  
Reading Quiz 9: Tuesday, 9/26  
Reading Quiz 10: Tuesday, 9/26 |
| Week 7 10/2 | **ArcGIS: Data Models** | Bolstad: Ch 2  
Goodchild 1992  
Written Assignment 3 (Elective)  
Final Project Proposal  
Reading Quiz 12 | Geodesy Quiz: Tuesday, 10/3  
Written Assignment 2: Tuesday, 10/3  
ArcGIS Tutorial 5: Tuesday, 10/3  
Reading Quiz 11: Tuesday, 10/3 |
| Week 8 10/9 | **ArcGIS: Vector Analysis** | Bolstad: Ch 9  
Wright et al. 1997  
Written Assignment 4 (Elective)  
GIS Data Tutorial 1  
Reading Quiz 13 | Written Assignment 3: Tuesday, 10/10  
Final Project Proposal: Tuesday, 10/10  
Reading Quiz 12: Tuesday, 10/10  
Responses to Proposals: Thursday, 10/12 |
| Week 9 10/16 | **ArcGIS: Raster Analysis** | Bolstad: Ch 10  
Reitsma 2013  
Written Assignment 5 (Elective)  
GIS Data Tutorial 2  
Reading Quiz 14 | Written Assignment 4: Tuesday, 10/17  
GIS Data Tutorial 1: Tuesday, 10/17  
Reading Quiz 13: Tuesday, 10/17  
Individual Meetings with Professor re Project Proposal: TBD |
| Week 10 10/23 | **GIST Domains** | Duckham 2015  
DiBiase et al. 2007  
Written Assignment 6 (Required)  
GIS Data Tutorial 3  
Reading Quiz 15 | Written Assignment 5: Tuesday, 10/24  
GIS Data Tutorial 2: Tuesday, 10/24  
Reading Quiz 14: Tuesday, 10/24 |
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<td><strong>Week 11</strong></td>
<td>Geographic Information Systems</td>
<td>Bolstad: Ch 1&lt;br&gt;Discussion Forum 4&lt;br&gt;Written Assignment 7 (Required)&lt;br&gt;Reading Quiz 16</td>
<td>Written Assignment 6: Tuesday, 10/31&lt;br&gt;GIS Data Tutorial 3: Tuesday, 10/31&lt;br&gt;Reading Quiz 15: Tuesday, 10/31</td>
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<td>10/30</td>
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<td>Wilson &amp; Fotheringham eds.: An Introduction&lt;br&gt;Goodchild 1992&lt;br&gt;Wright et al. 1997&lt;br&gt;Reitsma 2013&lt;br&gt;Kitchin &amp; Dodge 2007&lt;br&gt;Discussion Forum 5&lt;br&gt;Written Assignment 8 (Elective)&lt;br&gt;Final Project Data Report&lt;br&gt;Reading Quiz 16</td>
<td>Discussion Forum 4 Posts: Tuesday, 11/7&lt;br&gt;Written Assignment 7: Tuesday, 11/7&lt;br&gt;Reading Quiz 16: Tuesday, 11/7&lt;br&gt;Responses to Discussion Forum 4: Thursday, 11/9</td>
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<td><strong>Week 12</strong></td>
<td>Geographic Information Science</td>
<td>Bolstad: Ch 13&lt;br&gt;Mitchell: Ch 2&lt;br&gt;Batty et al. 2010&lt;br&gt;Written Assignment 9 (Elective)&lt;br&gt;Reading Quiz 18</td>
<td>Discussion Forum 5 Posts: Tuesday, 11/14&lt;br&gt;Written Assignment 8: Tuesday, 11/14&lt;br&gt;Final Project Data Report: Tuesday, 11/14&lt;br&gt;Reading Quiz 17: Tuesday, 11/14&lt;br&gt;Responses to Discussion Forum 5: Thursday, 11/16&lt;br&gt;Responses to Data Reports: Thursday, 11/16</td>
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<td>11/6</td>
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<td>Kimerling et al.: Introduction&lt;br&gt;Slocum et al.: Ch 2&lt;br&gt;Goodchild 2012&lt;br&gt;Written Assignment 10 (Elective)&lt;br&gt;Reading Quiz 19&lt;br&gt;Final Project Final Report</td>
<td>Written Assignment 9: Tuesday, 11/21&lt;br&gt;Reading Quiz 18: Tuesday, 11/21</td>
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<td><strong>Week 13</strong></td>
<td>Maps and Spatial Analysis</td>
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<td><strong>Week 14</strong></td>
<td>Cartography and the History of Maps</td>
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*11/22-11/26 is a university holiday
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<th>Week 15</th>
<th>Future Trends of Maps and GIS</th>
<th>Written Assignment 10: Tuesday, 11/28</th>
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<td>11/27</td>
<td>Bolstad: Ch 15 Wilson &amp; Fotheringham eds.: Ch 33&amp;34 Discussion Forum 6 Reading Quiz 20 Final Project Final Report</td>
<td>Reading Quiz 19: Tuesday, 11/28 Discussion Forum 6: No later than 05:00 pm PT on Friday, 12/1 Reading Quiz 20: No later than 05:00 pm PT on Friday, 12/1 Final Project Final Report: No later than 05:00 pm PT on Friday, 12/1</td>
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| Final Exam | Final Project Presentation | Final Project Presentation: Date and time for presentation slots will be scheduled. |

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**Statement on Academic Conduct and Support Systems**

**Academic Conduct**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” [https://policy.usc.edu/scampus-part-b/](https://policy.usc.edu/scampus-part-b/). Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, [http://policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

**Support Systems**

**Student Counseling Services (SCS)** - (213) 740-7711 – 24/7 on call  
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [https://engemannshc.usc.edu/counseling/](https://engemannshc.usc.edu/counseling/).

**National Suicide Prevention Lifeline** - 1-800-273-8255  
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [http://www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org).

**Relationship & Sexual Violence Prevention Services (RSVP)** - (213) 740-4900 - 24/7 on call  
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [https://engemannshc.usc.edu/rsvp/](https://engemannshc.usc.edu/rsvp/).

**Sexual Assault Resource Center**  
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: [http://sarc.usc.edu](http://sarc.usc.edu).
Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/.

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/.

Student Support & Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/.

Diversity at USC – https://diversity.usc.edu/
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students.

Resources for Online Students
The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/. Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. This includes instructional videos, remote access to university resources, and other key contact information for distance students.