Course Name: Cloud Application Development
Course Number: CS 493, Spring 2024
Credits: 4
Instructor name: Nauman Chaudhry (Section 400, 401, 402, 403)
Instructor email: chaudhrn@oregonstate.edu
Teaching Assistant name and contact info: TBA

Course Description
Covers developing RESTful cloud services, an approach based on representational state transfer technology, an architectural style and approach to communications used in modern cloud services development.
Prerequisites: CS 290 and CS 340 and CS 372

Communication

Canvas Notifications
Make sure to turn on Canvas Notifications for Announcements and Grading Comments. The instructional team will be using Canvas Announcements extensively to communicate with you. It is your responsibility to keep up to date with these announcements and they are considered part of the required learning material.

Ed Discussion Board for Questions about Course Content & Assignments
Ask questions about assignments and course content, on the Ed discussion board, as opposed to direct messages to the instructors or the TAs. You will also get an answer to your question far faster by posting it on the Ed discussion board than by emailing or sending a private message, as there are more than a hundred people looking at those discussion boards. We will strive that questions asked on Ed by the end of one business day are answered by the end of the next business day. The instructor is not available over the weekend or over university holidays.

Microsoft Teams for Office Hours & Real-Time Communication
We will conduct office hours using Microsoft Teams using the Team created for this course. The times for office hours will be listed on the course homepage. You can also ask questions of other students on Teams. However, if the instructors or the TAs are not on Teams when the question is asked, don’t count on us reading the scroll back to find a question you asked earlier: your primary method for getting help is still Ed.

Canvas for Grading Questions & Regrading Requests

This course is offered through Oregon State University Extended Campus. For more information visit: http://ecampus.oregonstate.edu.
We will attempt to grade the assignments within 7 days of the late due date.

A comment on your submission in Canvas will tell you who has graded your assignment. You can request a regrade on an assignment by replying in the Grades > Assignment > Comment box within 4 business days of the grade being released. Include notes about which points you think were taken off incorrectly, and why you think your assignment does in fact meet the requirements for those items.

Students should turn on Canvas > Notifications > Notification Settings -> Submission Comments to be notified of comments on their submissions.

When requesting a regrade, the grade will NEVER be lower than when you made the request, unless we discover a case of academic dishonesty. We will not lower a grade for finding something else wrong. That said, please note that while reviewing your request if we discover we made a mistake in taking points but also made a mistake in not deducting points, it is possible your grade will remain the same.

Email Instructor for Assignment Extensions, Escalated Grading Questions, General Course Information & Personal Questions
For assignment extensions, escalated grading questions, other general course information or personal questions, email the instructor at his OSU email address (don’t send an email via Canvas inbox). You must send the email from your OSU account. Emails sent from non-OSU accounts will be ignored due to possible FERPA issues. Start the subject line of your email with CS 493. The instructor will strive that an email received by the end of one business day is answered within the next 2 business days. The instructor is not available over the weekend or over university holidays.

Course Credits
This course combines approximately 120 hours of instruction, online activities, and assignments for 4 credits.

Technical Assistance
If you experience any errors or problems while in your online course, contact 24-7 Canvas Support through the Help link within Canvas. If you experience computer difficulties, need help downloading a browser or plug-in, or need assistance logging into a course, contact the IS Service Desk for assistance. You can call (541) 737-8787 or visit the IS Service Desk online.

Learning Resources
There is no textbook for this course. There will be required articles and other material from the internet posted on the course website as the course progresses.
This course meets the Affordability Matters badge in recognition of its low-cost materials. At Oregon State, we believe that affordable learning materials are essential to faculty and students, so the Affordability Matters initiative was created to recognize faculty who are actively working to lower the cost of course materials to $40 or less.

**Measurable Student Learning Outcomes**

At the completion of this course, students will be able to:

1. **Design** and implement an effective RESTful API, using appropriate HTTP verbs (GET, POST, DELETE, etc.) to access specific API resources.
2. **Evaluate** various approaches to representing data in API requests and responses and to alerting users of errors.
3. **Use** modern tools and techniques for storing API data.
4. **Use** modern techniques to replicate and synchronize data to ensure data safety and consistency.
5. **Employ** secure mechanisms for authenticating users and authorizing the use of specific portions of an API.
6. **Use** modern tools and techniques to queue and process API requests.
7. **Select** an available open-source search index to meet an API’s information retrieval needs.
8. **Create** a publicly available cloud API.
9. **Evaluate** an API’s performance and reliability using appropriate metrics.

**Evaluation of Student Performance**

Final grades will be comprised of the following weighted components:

- 100% 6 programming assignments

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percent Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt;= 93%</td>
</tr>
<tr>
<td>A-</td>
<td>&gt;= 90% &amp; &lt; 93%</td>
</tr>
<tr>
<td>B+</td>
<td>&gt;= 87% &amp; &lt; 90% (e.g., an 89.99% would be a B+)</td>
</tr>
<tr>
<td>B</td>
<td>&gt;= 83% &amp; &lt; 87%</td>
</tr>
<tr>
<td>B-</td>
<td>&gt;= 80% &amp; &lt; 83%</td>
</tr>
<tr>
<td>C+</td>
<td>&gt;= 77% &amp; &lt; 80%</td>
</tr>
<tr>
<td>C</td>
<td>&gt;= 73% &amp; &lt; 77%</td>
</tr>
<tr>
<td>C-</td>
<td>&gt;= 70% &amp; &lt; 73%</td>
</tr>
<tr>
<td>D+</td>
<td>&gt;= 67% &amp; &lt; 70%</td>
</tr>
<tr>
<td>D</td>
<td>&gt;= 63% &amp; &lt; 67%</td>
</tr>
<tr>
<td>D-</td>
<td>&gt;= 60% &amp; &lt; 63%</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 60%</td>
</tr>
</tbody>
</table>

**Course Content**

We will use Google Cloud Platform (GCP) in this course.
For implementing the assignments, you will use Python & Flask Node.js. The instructors, at their discretion, may allow use of additional languages/platforms beyond this default these two choices.

Here are the major course topics

- RESTful API design and implementation
- Resources, routing, and HTTP verbs
- Data representation and errors
- Data storage models
- Data replication and synchronization
- Authentication and authorization
- Cloud API deployment
- API performance, reliability, and scaling

<table>
<thead>
<tr>
<th>Module</th>
<th>Topic</th>
<th>Learning Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Cloud Computing</td>
<td>Syllabus Quiz Assignment 1: Google App Engine</td>
</tr>
<tr>
<td>2</td>
<td>Introduction to REST APIs</td>
<td>Assignment 2: REST API Implementation</td>
</tr>
<tr>
<td>3</td>
<td>Implementing REST APIs</td>
<td>Assignment 2 continued</td>
</tr>
<tr>
<td>4</td>
<td>Containerization and Docker</td>
<td>Assignment 3: REST API with Docker &amp; MySQL</td>
</tr>
<tr>
<td>5</td>
<td>Implementing REST APIs Using MySQL</td>
<td>Assignment 3 continued</td>
</tr>
<tr>
<td>6</td>
<td>Authentication &amp; Authorization</td>
<td>Assignment 4: OAuth 2.0</td>
</tr>
<tr>
<td>7</td>
<td>Security &amp; JWTs</td>
<td>Assignment 5: Securing REST APIs with JWTs</td>
</tr>
<tr>
<td>8</td>
<td>Storing Files in the Cloud</td>
<td>Assignment 6: Portfolio Project</td>
</tr>
<tr>
<td>9</td>
<td>Data Replication &amp; the CAP Theorem</td>
<td>Assignment 6 continued</td>
</tr>
<tr>
<td>10</td>
<td>Architecting Cloud Applications</td>
<td>Assignment 6 continued</td>
</tr>
<tr>
<td>Finals</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Course Policies**

**Late Work Policy**

- All assignments must be submitted on Canvas, according to the posted due date and time.
- All assignments, including the final assignment, can be submitted within 48 hours of the due date, with the following penalties:
  - Assignments submitted within 24 hours of the due date will be accepted with a penalty of 2.5% of the total possible points for the assignment.
  - Assignments submitted within 48 hours of the due date will be accepted with a penalty of 5% of the total possible points for the assignment.
• Note the late penalties are off the total possible points, not the points you earn. E.g., if an assignment has 10 points, then a late submission within 24 hours of the due date will be deducted 0.25 points.
• Assignments submitted later than 48 hours of the due date will not be accepted without a documented medical or family emergency and will receive a grade of 0.

Incompletes
Incomplete (I) grades will be granted only in emergency cases (usually only for a death in the family, major illness or injury, or birth of your child), and if the student has turned in 70% of the points possible (in other words, usually everything but the final exam). If you are having any difficulty that might prevent you completing the coursework, please don’t wait until the end of the term; let me know right away.

Statement Regarding Religious Accommodation
Oregon State University is required to provide reasonable accommodations for employee and student sincerely held religious beliefs. It is incumbent on the student making the request to make the faculty member aware of the request as soon as possible prior to the need for the accommodation. See the Religious Accommodation Process for Students.

Guidelines for a Productive and Effective Online Classroom
Students are expected to conduct themselves in the course (e.g., on discussion boards, email) in compliance with the university’s regulations regarding civility. Civility is an essential ingredient for academic discourse. All communications for this course should be conducted constructively, civilly, and respectfully. Differences in beliefs, opinions, and approaches are to be expected. In all you say and do for this course, be professional. Please bring any communications you believe to be in violation of this class policy to the attention of your instructor.

Active interaction with peers and your instructor is essential to success in this online course, paying particular attention to the following:
• Unless indicated otherwise, please complete the readings and view other instructional materials for each week before participating in the discussion board.
• Read your posts carefully before submitting them.
• Be respectful of others and their opinions, valuing diversity in backgrounds, abilities, and experiences.
• Challenging the ideas held by others is an integral aspect of critical thinking and the academic process. Please word your responses carefully, and recognize that others are expected to challenge your ideas. A positive atmosphere of healthy debate is encouraged.

Academic Calendar
All students are subject to the registration and refund deadlines as stated in the Academic Calendar: https://registrar.oregonstate.edu/osu-academic-calendar

This course is offered through Oregon State University Extended Campus. For more information visit: http://ecampus.oregonstate.edu.
Statement Regarding Students with Disabilities
Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval, please contact DAS immediately at 541-737-4098 or at https://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Accessibility of Course Materials
All materials used in this course are accessible. If you require accommodations please contact Disability Access Services (DAS).

Additionally, Canvas, the learning management system through which this course is offered, provides a vendor statement certifying how the platform is accessible to students with disabilities.

Expectations for Student Conduct
Student conduct is governed by the university’s policies, as explained in the Student Conduct Code. Students are expected to conduct themselves in the course (e.g., on discussion boards, email postings) in compliance with the university's regulations regarding civility.

Student Bill of Rights
OSU has twelve established student rights. They include due process in all university disciplinary processes, an equal opportunity to learn, and grading in accordance with the course syllabus: https://asosu.oregonstate.edu/advocacy/rights

Ecampus Reach Out for Success
University students encounter setbacks from time to time. If you encounter difficulties and need assistance, it’s important to reach out. Consider discussing the situation with an instructor or academic advisor. Learn about resources that assist with wellness and academic success.

Ecampus students are always encouraged to discuss issues that impact your academic success with the Ecampus Success Team. Email ecampus.success@oregonstate.edu to identify strategies and resources that can support you in your educational goals.

For mental health:
Learn about counseling and psychological resources for Ecampus students. If you are in immediate crisis, please contact the Crisis Text Line by texting OREGON to 741-741 or call the National Suicide Prevention Lifeline at 1-800-273-TALK (8255).

For financial hardship:
Any student whose academic performance is impacted due to financial stress or the inability to afford groceries, housing, and other necessities for any reason is urged to contact the Director of Care for support (541-737-8748).

**Establishing a Positive Community**
It is important you feel safe and welcome in this course. If somebody is making discriminatory comments against you, sexually harassing you, or excluding you in other ways, contact the instructor, your academic advisor, and/or report what happened at [https://studentlife.oregonstate.edu/studentconduct/reporting](https://studentlife.oregonstate.edu/studentconduct/reporting) so we can connect you with resources.

**Academic Integrity**
The Code of Student Conduct prohibits Academic Misconduct and defines it as:

*Any action that misrepresents a student or group’s work, knowledge, or achievement, provides a potential or actual inequitable advantage, or compromises the integrity of the educational process.*

To support understanding of what can be included in this definition, the Code further classifies and describes examples of Academic Misconduct, as follows.

Prohibited behaviors include, but are not limited to doing or attempting the following actions:

- **Cheating.** Unauthorized assistance, or access to or use of unauthorized materials, information, tools, or study aids. Examples include, but are not limited to, unauthorized collaboration or copying on a test or assignment, using prohibited materials and texts, unapproved use of cell phones, internet, or other electronic devices, etc.
- **Plagiarism.** Representing the words or ideas of another person or presenting someone else's words, data, expressed ideas, or artistry as one's own. Examples include, but are not limited to, presenting another person's opinions and theories as one's own, using another person’s work or words (including unpublished material) without appropriate source documentation or citation, working jointly on a project and then submitting it as one's own, etc.
- **Falsification.** Fabrication or invention of any information. Examples include, but are not limited to, falsifying research, inventing or falsely altering data, citing fictitious references, falsely recording or reporting attendance, hours, or engagement in activities such as internships, externships, field experiences, clinical activities, etc.
- **Assisting.** Any action that helps another engage in academic misconduct. Examples include, but are not limited to, providing materials or assistance without approval, altering someone else’s work, grades or academic records, taking a test/doing an assignment for someone else, compelling acquisition, selling, bribing, paying or accepting payment for academic work or assistance that contributes to academic misconduct, etc.
- **Tampering.** Interfering with an instructor’s evaluation of work by altering materials or documents, tampering with evaluation tools, or other means of interfering.
- **Multiple submissions of work.** Using or submitting work completed for another or previous class or requirement, without appropriate disclosure, citation, and instructor approval.
- **Unauthorized recording and use.** Recording and/or dissemination of instructional content without the express permission of the instructor(s), or an approved accommodation coordinated via Disability Access Services.
It is important that you understand what student actions are defined as academic misconduct at Oregon State University. The OSU Libraries offer a tutorial on academic misconduct, and you can also refer to the OSU Student Code of Conduct and the Office of Student Conduct and Community Standard’s website for more information. More importantly, if you are unsure if something will violate our academic integrity policy, ask your professors, GTAs, academic advisors, or academic integrity officers.

Code Reuse & Citation

Any use of code other than your own must conform to the following guidelines:

- Comment block endpoints of the non-original code (BEGIN...END)
- A non-source statement (e.g., “This is not my original code”)
- A detailed prose description of the functionality of the code (How it works)

EXAMPLE:

`; *****BEGIN CITED CODE*****
; The following code is not my own.
; SOURCE: https://stackoverflow.com/RandomWrongMethod
; The code begins by utilizing the irvine library function ReadInt to read
; an integer value from stdin. It then checks this user input against the
; constants UPPER_LIMIT and LOWER_LIMIT. If the value is within the target
; range (below UPPER_LIMIT and above LOWER_LIMIT) the value is moved into
; the loop counter ECX. A line counter (to enable displaying 5 numbers per
; line) is initialized, and the program will start displaying Fib Values.
; If it is outside the specified range, an error message is printed and it
; will prompt again for user input.

getUserData:
call ReadInt
    mov num_numbers, eax
    ...
; *****END CITED CODE*****

TurnItIn
Your instructor may ask you to submit one or more of your writings to Turnitin, a plagiarism prevention service. Your assignment content will be checked for potential plagiarism against Internet sources, academic journal articles, and the papers of other OSU students, for common or borrowed content. Turnitin generates a report that highlights any potentially unoriginal text in your paper. The report may be submitted directly to your instructor or your instructor may elect to have you submit initial drafts through Turnitin, and you will receive the report allowing you the opportunity to make adjustments and ensure that all source material has been properly cited. Papers you submit through Turnitin for this or any class will be added to the OSU Turnitin database and may be checked against other OSU paper submissions. You will retain all rights to your written work. For further information, visit Academic Integrity for Students: Turnitin – What is it?

Using AI Tools

This course is offered through Oregon State University Extended Campus. For more information visit: http://ecampus.oregonstate.edu.
Here is the course policy on using AI Tools.

1. Students are **not allowed to use ChatGPT (and other AI tools) for generating code.** These tools also cannot be used to generate responses for any essay-type questions.

2. Students are **allowed to use ChatGPT (or other AI tools) as they would use a library resource.** If you use an AI tool for this purpose, create a private Ed thread and explain how you used the tool. I will review your post and give you feedback on whether or not the use is legitimate as far as this class is concerned. If the use of the tool is legitimate and can be of general interest for the class, I will share it publicly on Ed. An example of an OK use is to find solutions for errors related to deploying code to the Google Cloud Platform.

Please note that my goal with this policy is to not be overly restrictive, but to make sure that the course learning objectives are not compromised. I recognize that ChatGPT, Bard, etc. are going to be very important tools for software development. If you have feedback and suggestions on how you think these tools should be used in this course, I would welcome that anytime during and after the course.

**Tutoring and Writing Assistance**

For academic support provided to current College of Engineering students (which includes Computer Science students) see [the College of Engineering Academic Support page](http://ecampus.oregonstate.edu).

The Oregon State [Online Writing Suite](http://ecampus.oregonstate.edu) is also available for students enrolled in Ecampus courses.

**Student Evaluation of Courses**

Students receive notification, instructions and the link through their ONID when *The online Student Learning Experience Survey* opens to students. They may also log into the system via Online Services. Course evaluation results are extremely important and used to help improve courses and the hybrid learning experience for future students. Responses are anonymous (unless a student chooses to “sign” their comments, agreeing to relinquish anonymity) and unavailable to instructors until after grades have been posted. The results of scaled questions and signed comments go to both the instructor and their unit head/supervisor. Anonymous (unsigned) comments go to the instructor only.