College of Engineering and Computer Science

Department of Computer Science

CPSC 583: Expert Systems Design Theory

Fall 2024

## Instructor

Dr. Anand Panangadan

Phone: 657-278-3998

Email: [apanangadan@fullerton.edu](mailto:apanangadan@fullerton.edu) (Email is the best way of reaching me)

Office Hours (on campus and on Zoom):

Thursdays 4-7pm

During final exam week, office hours are by appointment only.

**Office: CS 548**

**Zoom link:** [**https://fullerton.zoom.us/j/783606364?pwd=Rm9JNndqbUZWTWNmZEE1OGdWN3pBQT09**](https://fullerton.zoom.us/j/783606364?pwd=Rm9JNndqbUZWTWNmZEE1OGdWN3pBQT09)

## Meeting Information

CPSC 583-02: Th 7:00PM - 9:45PM Classroom: EC 121

## Final Exam Dates

[Final Exam Schedule - Scheduling Office | CSUF](http://www.fullerton.edu/scheduling/final_exam_schedule/)

CPSC 583-02: 12/19/2024, Thursday, 7:00PM - 8:50PM

## Student Technical support:

* (657) 278-8888
* StudentITHelpDesk@fullerton.edu
* [Help Desk - Division of Information Technology](http://www.fullerton.edu/it/students/helpdesk/index.php)
* Chat with IT: Log into:<http://my.fullerton.edu/> and Click ***Online IT Help***Click on ***Live Chat***
* Canvas Support Hotline: 855-302-7528
* [Canvas Support Chat Faculty](https://cases.canvaslms.com/liveagentchat?chattype=admin&sfid=001A000000YzcwQIAR) / [Canvas Support Chat Student](https://cases.canvaslms.com/liveagentchat?chattype=student&sfid=001A000000YzcwQIAR)

# Description & Objectives

Overview of expert systems; knowledge representation; search strategies for expert systems; logic programming; logical inference; reasoning under uncertainty; Course Project

# Learning Goals

1. Define and describe the basic concepts of an expert system
2. List different knowledge representation methods, describe their relative advantages, and apply them in simple applications
3. List methods of logical inference and describe their strengths and shortcomings
4. Describe different methods of dealing with uncertainty in our information of an application domain along with their strengths and shortcomings
5. Use an expert system to build a system for a specific application

# G.E. Requirements

This class does not meet any CSU General Education requirements.

# Important Dates

CSUF’s Academic Calendar is posted online at «<http://apps.fullerton.edu/AcademicCalendar/>». The Academic Calendar contains all the campus closures and holidays you should be aware of.

CSUF’s Admissions Calendar is posted online at «<http://admissions.fullerton.edu/apps/calendars.aspx>». The Admissions Calendar contains all the major dates with respect to adding, dropping, and withdrawing from your classes.

The final exam schedule is at [Final Exam Schedule - Scheduling Office | CSUF](http://www.fullerton.edu/scheduling/final_exam_schedule/). Makeup exams are only available by advance request for documented exceptional circumstances.

# Textbooks

## Required

[RN] *Artificial Intelligence A Modern Approach,* Stuart Russell and Peter Norvig, **4th edition**

This textbook is available through the Titan Direct Access Program and can be accessed through the “Titan Direct Access” button in the My Courses section of the student portal or directly through canvas. **If you prefer not to participate in Titan Direct Access, you should simply opt-out of the materials by 9/10/2024** through the student portal button. If you decide to maintain access, you will be billed following the 9/10/2024 deadline and must make your payment by 9/20/2024 on your Titan Shops account. Students with outstanding balances after 9/20/2024 will have their digital access and bill removed with no further action needed. You can learn more about Titan Direct Access at <http://www.fullerton.edu/it/students/titandirectaccess/>

Many popular technical books may be read online through the campus’s subscription to [OReilly (previously Safari) Tech Books](https://learning.oreilly.com/home/). From outside of the campus network, the campus library’s WWW proxy will grant you access.

# Course Outline (Subject to change)

| **Week** | **Material** | **Textbook Sections** |
| --- | --- | --- |
| 1 | Introduction; Propositional Logic | RN 1.3, 7.1-7.4 |
| 2 | Propositional Logic proofs | RN 7.5 |
| 3 | Backward chaining, Introduction to Prolog | RN 9.4 |
| 4 | Predicate Logic, Knowledge Engineering using Predicate Logic | RN 8.1-8.4 |
| 5 | Predicate Logic proofs: resolution | RN 9.1,9.2,9.5 |
| 6 | Description Logics |  |
| 7 | Ontologies | RN 10.1-10.5 |
| 8 | Knowledge graphs: Semantic Web; Project announcement |  |
| 9 | Mid-term |  |
| 10 | Bayes rule, inference with joint probabilities | RN 12 |
| 11 | Bayesian networks | RN 13.1-13.3 |
| 12 | Natural language models: bag-of-words | RN 23.1 |
| 13 | Natural language models: word embeddings | RN 24.1 |
|  | *Fall recess* |  |
| 14 | Reasoning over time |  |
| 15 | Project presentations |  |
| finals | *final exam* (covers material after midterm) |  |

# Technical Requirements

**Programming assignments will be specified in different languages that you have likely not used before: CLIPS and Prolog.** Students can use the Computer Science Department’s official Linux development environment, Tuffix. Tuffix is Tuffy the Titan’s Linux distribution. You can set up Tuffix as a native install on a dedicated computer, or as a virtual machine (VM), by following the [Tuffix Installation Instructions](https://github.com/kevinwortman/tuffix/blob/master/install.md). You can use your own computer, or borrow a computer from CSUF for free through the [Long-Term Laptop Checkout](https://www.fullerton.edu/it/students/equipment/longtermlaptop.php) process.

Another option is CSUF’s [Virtual Computing Lab (VCL)](https://www.fullerton.edu/it/services/vcl/index.php). This allows you to connect remotely to a Tuffix-like environment. Keep in mind a VCL session only lasts a limited time (up to 4 hours) and *is erased at the end of the session,* so you *must save your work elsewhere before your session ends* (e.g. git push all your work before the session ends).

Students using Tuffix should join the [CSUF TUFFIX](https://csuf-tuffix.slack.com) slack workspace at<https://csuf-tuffix.slack.com>. Please use the #general channel to ask about troubleshooting, installing, and using Tuffix.

Students are also expected to

1. Have basic computer competency which includes:
   1. the ability to use a personal computer to locate, create, move, copy, delete, name, rename, and save files and folders on hard drives, secondary storage devices such   
      as USB drives, and cloud such as Google Drive (Titan Apps);
   2. the ability to use a word processing program to create, edit, format, store, retrieve, and print documents;
   3. the ability to use their CSUF email accounts to receive, create, edit, print, save, and send an e-mail message with and without an attached file; and
   4. the ability to use an Internet browser to search and access web sites in the World Wide Web.
2. Have ongoing reliable access to a computer with Internet connectivity for regular course assignments
3. Access their CSUF student email account
4. Use Internet search and retrieval skills to complete assignments
5. Apply their educational technology skills to complete expected competencies
6. Utilize other software applications as course requirements dictate

# Grading

Final grades are computed by first finding the average score in each category described below. All scores are normalized to a scale of 0 to 100 before being averaged. The average score for each category is then used to compute the weighted average.

* **Homework: 25%**
* **Course participation: 5%**
* **Project: 20%**
* **Midterm: 25%**
* **Final: 25%**

In this course the plus/minus system will be used. The grade breakdown is as follows:

98 – 100% = A+

93 - 97% = A (outstanding performance)

90 – 92% = A-

87 – 89% = B+

83 – 86% = B (good performance)

80 – 82% = B-

77 – 79% = C+

73 – 76% = C (acceptable performance)

70 – 72% = C-

67- 69% = D+

63 – 66% = D (poor performance)

60 – 62% = D-

0 – 59% = F

I reserve the right to *decrease* these boundaries, but *will not increase* them. In other words, I have leeway to adjust the boundaries downward, awarding higher letter grades, to compensate for assignments that were too difficult. In general I do not adjust grade boundaries unless the unadjusted class average is significantly lower than the department's GPA average.

# Grade calculations

I record assignment grades on Canvas. Please check them for accuracy weekly. Canvas calculates your grade automatically. These calculations are based only on the grades that are currently available. So, for example, the grade calculation will ignore the homework category until I've graded the first assignment.

# Assignments

Programming and written assignments will be discussed in class and posted to the course website in advance of their due dates.

All programming assignments must be written in the programming language(s) specified as part of the assignment. Coding style must conform to professional norms. At a minimum, code must be commented, have descriptive names for identifiers, and contain a comment with pertinent information such as the student’s name, email address, and assignment name.

## Homework

Students can work in groups of 1-3 people. Each group will be responsible for completing each assignment without collaborating with other groups in the class. The outcome of each homework assignment will be a written report and/or source code with the solutions to the assigned problems (one per group) and must be submitted electronically on Canvas.

## Project

There will be one **course project** which will involve designing, implementing, and analyzing a substantial program in a programming language of your choice. Students will present their course project to the whole class during the last week of the semester. The project can be completed in a group.

## Examinations

The midterm and final are not cumulative. All exams are to be completed individually. Please be on time for the exams. No one will be allowed to begin taking an exam after the first student has completed the exam. Additional aids (e.g., calculators) or support materials may be used as described by the instructor prior to each exam. Make-up exams will be considered only in the most extraordinary of circumstances, such as serious illness or accident (written documentation will be required).

# Alternative Procedure for Submitting Work

In case of technical difficulties with Canvas, the instructor will communicate with students directly through CSUF email, and assignments can be sent through email. In the case email doesn’t work, students should call the Computer Science department coordinator at 657-278-3700 for further direction.

## Attendance Policy

Attending lectures is mandatory. Students are responsible for all course material and announcements regardless of whether they are present or absent.

Missing class as part of a documented accommodation is guaranteed to be excused. The ADA accommodated student must make a reasonable effort to coordinate any absences with the instructor.

### Religious/Cultural Observance

Students who have religious or cultural observances that coincide with this class should let me know by e-mail. I strongly encourage you to honor your cultural and religious holidays! However, if I do not hear from you, I will assume that you plan to attend all class meetings.

## Administrative drops

Any student who misses the first class meeting may be dropped from the class, unless they contact the instructor within 24 hours.

## Make Up Policy

The following kinds of projects cannot be evaluated, and will be assigned a zero score:

* Late submissions.
* Email submissions.
* Source code that cannot be executed successfully.
* Input/output that is falsified or does not match the submitted source code.
* Submissions that are plagiarized or otherwise violate the collaboration guidelines.

## Extra Credit

# There are no opportunities for extra credit.

## Collaboration

Collaboration is *not* allowed on any **exam**. You may work on **homework** and **projects** in groups of **1-3**. When you work in a group, make one submission with all group members’ names. You may work freely with your fellow group members, but must limit the input you get from sources *outside* your group:

* You may help each other understand the assignment and brainstorm general solutions, but each group must develop and submit their own distinct work.
* You may give each other technical support, for instance troubleshooting installing Python.
* You must separate to develop your own detailed solution to the problem, and type in your own source code and project report.
* Given these requirements, any submissions with identical excerpts, or excerpts that are identical up to superficial rearrangements, will be considered highly suspect of plagiarism.

## Response Time

I try to respond to all emails within two working days, but occasionally may take longer than that. .

## Communication

All course announcements and individual email are sent through Canvas, which only uses CSUF email accounts. Therefore, you MUST check your CSUF email on a regular basis (several times a week) for the duration of the course. During office hours, I am available in-person and online on Zoom.

## Participation

Participation includes the following:

* Arriving to class prepared and on time.
* Taking notes.
* Actively listening to the lecture and asking questions when appropriate.
* Participating actively in breakout sessions.
* Bringing any required materials to class.
* When needed/desired, seeking assistance to complete assignments.
* Barring an emergency, not leaving the class session early unless the instructor consents.
* Not distracting oneself or others with smartphones, games, online diversions, etc.
* Respecting and treating the instructor and the student’s peers civilly.

## Important University Information and Student Policy Website

[Most recent information on university information and student policies](http://fdc.fullerton.edu/teaching/syllabus.php)

These include:

* Undergraduate, General Education, and Graduate Student Learning Goals
* [Student Learning Outcomes by Degree Programs: Computer Science](https://www.fullerton.edu/data/assessment/program_slos/ecs_bs_comsci.php)
* [Students’ Rights to Accommodation](https://www.fullerton.edu/dss/faculty_staff/rights.php)
* Campus Student Support Resources, including
  + Counseling and Psychological Services
  + Title IX and Gender Equity
  + Diversity Initiatives and Resource Centers
  + Basic Needs Services
* [Academic Integrity Policy](http://www.fullerton.edu/canvassupportresources/academic/)
* [Emergency Preparedness](https://adminfin.fullerton.edu/emergency/)
* [Library Services](http://www.library.fullerton.edu/)
* [Student IT Services and Competencies](https://www.fullerton.edu/it/students/)
* [Software Privacy and Accessibility](https://oet.fullerton.edu/resources/software_qm_guides.php)
* Accessibility Statement
* [Diversity Statement](https://hr.fullerton.edu/diep/)
* [Land Acknowledgement](http://together.fullerton.edu/land-acknowledgement/)
* [Final Exams Schedule](https://www.fullerton.edu/scheduling/final_exam_schedule/)
* [Academic Calendar](https://apps.fullerton.edu/AcademicCalendar/)

## Point of View

The readings, class lecture, and my comments in class will suggest a particular point of view. This perspective is my own and **does not have to be yours**! I encourage you to disagree with the ideas in the readings and lectures as well as the perspectives of your colleagues in the course. **Please express yourself**!! A significant part of a college education is learning about the complexity of various issues; therefore, it is important that we listen and respect one another but we do not have to agree. A richer discussion will occur when a variety of perspectives are presented in class for discussion.

## Netiquette

Each student is expected to conduct themselves in a professional manner during the class - taking full advantage of the learning opportunities available. This includes completing all online discussions and assignments, adhering to proper netiquette, and so on. Netiquette refers to a set of behaviors that are appropriate for online activity - especially with email and threaded discussions. The core rules of netiquette can be found at the [Netiquette website](http://www.albion.com/netiquette/corerules.html). Please read through these netiquette rules to ensure that you are familiar with what will be the expected online behavior for this course.

## Recording of Class Sessions

Any time that a class session is recorded, students will be notified. If students do not want their likeness during class participation included in the recorded class session, they may elect to not participate via video recordings. Recordings will be available for viewing during the Remote Instruction Period subject to the following:

* Only students enrolled in the subject class during the Remote Instruction Period may view the recording.
* Any recording of class content is for private use and study and shall not be made publicly accessible (e.g., social media) without the written consent of the instructor and students in the class.

## Academic Dishonesty

By submitting work for evaluation, the student acknowledges that he/she has adhered to the spirit of the university’s academic honesty policy and that his/her submission is an original work done by the student unless otherwise directed to work in groups. You are responsible for being aware of and following the spirit of CSU Fullerton’s academic honesty policy found at <http://www.fullerton.edu/senate/publications_policies_resolutions/ups/UPS%20300/UPS%20300.021.pdf> . Academic dishonesty includes such things as cheating, inventing false information or citations, plagiarism, and helping someone else commit an act of academic dishonesty. It usually involves an attempt by a student to show a possession of a level of knowledge or skill, which he/she in fact does not possess.  
Cheating is defined as the act of obtaining or attempting to obtain credit for work by the use of any dishonest, deceptive, fraudulent or unauthorized means. Examples of cheating include, but are not limited to using notes or aids or help of other students on tests and examinations in the ways other than those expressly permitted by the instructor, plagiarism as defined below, tampering with grading procedure, and collaborating with others on any assignment where such collaboration is expressly forbidden by the instructor. Plagiarism is defined as the act of taking the specific substance of another and offering it as one's own without giving credit to the source (e.g., copying another person's program).

When you use sources, you must acknowledge the original author or source following standard scholarly practice. **You are not allowed to use any material from any website that provides solutions to the assignments given in class.**  
Failure to follow the spirit of the academic honesty policy will result in a severely negative evaluation of your work in question. Each offense will be reported to the Department Chair and to the Dean of Students office, Student Conduct. A first offense will result in a zero score on the offending assignment. A subsequent offense will result in an F in the course.

## Student Mental Health and Well-being

If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. Do not hesitate if you need support. For help, contact Counseling and Psychological Services (CAPS) 24/7 crisis phone services for students at (657) 278-3040 and <https://www.fullerton.edu/caps/>. Visit [YOU @ Fullerton](https://you.fullerton.edu/), a free and confidential wellness portal that connects students to academic, physical and mental health resources. I am also an Undergraduate Advisor for the Computer Science department and I can answer questions related to your progress towards your degree.

Please call 911 for any and all emergencies.

## Accessibility and Accommodations

Cal State Fullerton is committed to being a fully accessible campus. We strive to provide a safe and barrier-free learning environment for everyone, including those with any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive. This commitment includes our [facilities,](https://facilities.fullerton.edu/)

[technology](https://www.fullerton.edu/ati/), and [instructional materials](https://www.fullerton.edu/dss/current_students/att/aim.php). If you find yourself unable to fully access the space, content, or experience of this course, please contact [Disability Support Services (DSS)](https://nam10.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.fullerton.edu%2FDSS%2F%23gsc.tab%3D0&data=05%7C01%7Cefink%40fullerton.edu%7Ca327dce99f7948cc290208db14fa843e%7C82c0b871335f4b5c9ed0a4a23565a79b%7C0%7C0%7C638126838409432790%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=xmxgsOL26R5plJvUB2aOFK0vJio%2B6UWctcoS8hbQtKM%3D&reserved=0). A DSS counselor can help document your needs and create an accommodation plan, ensuring your privacy without disclosing your condition or diagnosis to your instructors (though you may voluntarily disclose, if you wish).

## Emergency Procedures

For your own safety and the safety of others, each student is expected to read and understand the guidelines published at «<http://prepare.fullerton.edu/campuspreparedness/>». Should an emergency occur, follow the instructions given to you by faculty, staff, and public safety officials. An emergency information recording is available by calling the Campus Operation and Emergency Closure line at 657-278-4444.

### Instructional Continuity

Due to an event such as an epidemic or a natural disaster that disrupts normal campus operations, students must monitor the course Titanium site and their campus email address for any instructions and assignments that the instructor announces.

## Acknowledgment

Portions of this syllabus are drawn from syllabi authored by Professors David Falconer, Matt Huffman, David A. Mix-Barrington, Mariko Molodowitch, Michael Shafae, Abhishek Verma, and Kevin Wortman. The syllabus also draws from material at CSU Fullerton’s [Faculty Development Center](https://fdc.fullerton.edu/teaching/syllabus.php), [ACUE Inclusive Teaching Practices Toolkit](https://acue.org/inclusive-teaching-practices-toolkit/#sec1).