

**INFO B442
Clinical Decision Support Systems**

**Department of BioHealth Informatics
Indiana University School of Informatics and Computing, Indianapolis
Spring 2022**

Section No.: 37028

Credit Hours: 3

Time: Course is online; Assignments are due Mondays at 8:00am

Location: Course is online

First Class: Monday, January 10, 2022

Website:

Prerequisites: None

Faculty Instructors: Suhila Sawesi, Ph.D., MPharm, BPharm

Communication policies:

- 1) Your email **must contain “B442” in the subject line (no space, no dash).** Failure to include this may result in the e-mail not being read or replied to.
- 2) **Office hours are by appointment.** Phone, Canvas chat or Zoom-based appointments are available but must be made by appointment.

Dr. Sawesi’s Office Hours and Contact Information

Office Hours: By appointment

Office: none

Contact: (317) 450-2965

Email: ssawesi@iu.edu

Course Description

This course provides a state-of-the-science overview of computer-based Clinical Decision Support (CDS) and CDS Systems (CDSS). Topics include: the design principles behind clinical decision support systems, CDSS usability and cognitive support, implementation science, mathematical foundations of the knowledge-based systems and pattern recognition systems, clinical vocabularies, legal and ethical issues, patient centered clinical decision support systems, and applications of clinical decision support systems in clinical practice.

Readings

Required and optional readings will be defined for each session and can be found in the weekly module. The readings consist of journal articles, a topic narrative, and slides. Additional independent readings may be recommended.

(1) Book: Greenes, R.A. (Ed.) Clinical Decision Support: The Road to Broad Adoption. 2014. Waltham, MA: Academic Press. ISBN: 978-0-12-398476-0

***Note: this is 2014 2nd edition of this book. The 2007 book (“The Road Ahead”) is outdated and will not be used. The 2007 book is not an acceptable replacement for the 2014 2nd edition! The 2014 2nd edition is available as a Kindle book or in hardcover.**

(2) Articles: Articles are provided by the instructor or lecturer. Required readings will be made available in Canvas within the weekly module.

(3) Slides and/or topic narrative: Each week the slides and/or topic narrative will be posted online in the weekly module. It is highly recommended that students read any required articles or book chapters before reviewing the slides and/or narrative.

(4) Software used:

Canvas (web), MS PowerPoint, Adobe PDF, Adobe Connect (web)

Course Outcomes:

Upon completion of this course, students will	RBT	PLUS	Core Comp.	Assessment
1. Define computer-based clinical decision support (CDS)	2	P1.4	1,4	Homework
2. Describe the infrastructure and components of a CDS system	2&3	P2.1	1, 2, 3, 4,7	Discussion Homework
3. Outline and discuss health care decision-making processes	3&5	P2.3 P3.1	1, 2,3,4,7	Discussion Homework Paper
4. Apply the mathematical foundations of CDS to health care decision-making processes and the design of a CDS system	4	P3.2	2, 3,4,7,8	Homework Paper Discussion
5. Describe different applications of CDS and application-specific issues	5	P3.1 P4.4	1,2,3,4,7	Discussion Homework Paper
6. Identify cognitive support, usability, and implementation problems and best-practices related to CDS	4&5	P3.1	1,2,3,4,7,8	Homework Discussion Paper

***RBT: Revised Bloom’s Taxonomy:** 1. Remembering, 2. Understanding, 3. Applying, 4. Analyzing, 5. Evaluating, 6. Creating

PROFILES OF LEARNING FOR UNDERGRADUATE SUCCESS (PLUS):

P1.4 Communicator –Convey ideas effectively and ethically in written form

P2.1 Problem Solver – Think critically

P2.3 Problem Solver – Analyzes, synthesizes, and evaluates

P3.1 Innovator – Investigates

P3.2 Innovator – Creates/designs

AMIA Core Competencies¹ covered in this course

- 1. Acquire professional perspective:** Summarize and explain the history and values of the discipline and its relationship to related fields while demonstrating an ability to read, interpret, and critique the core literature
- 2. Analyze problems:** Analyze, understand, abstract, and model a specific biomedical problem in terms of data, information and knowledge components
- 3. Work collaboratively:** Demonstrate the ability to team effectively with partners from diverse disciplines
- 4. Disseminate and discuss:** Communicate effectively to audiences in multiple disciplines in persuasive written and oral form
- 5. Evaluation:** controlled trials, observational studies, hypothesis testing, ethnographic methods, field observational methods
- 6. Ethical, Legal, Social Issues:** human subjects, HIPAA, informed consent, secondary use of data, confidentiality, privacy
- 7. Fundamental knowledge:** Understand the fundamentals of the field in the context of the effective use of biomedical data, information, and knowledge, particularly translational and clinical research, healthcare, providers, consumer health, quality assurance, safety, error reduction, medical records, personal health records, information security and privacy, population health
- 8. Procedural knowledge and skills:** For substantive problems related to scientific inquiry, problem solving, and decision making, analyze and critically evaluate solutions based on biomedical informatics approaches, particularly framing complex biomedical informatics problems in terms of data, information, and knowledge.

Teaching Strategies/Methods

The course is offered online.

Students will be asked to complete a variety of assignments.

Course Content and Instructors

Course content, timing, and readings may change. Updates will be posted on Canvas.

Week #	Topic	Readings
1	Definition, Scope and History of CDS	Greenes: Ch 1, 2
2	CDS System Adoption	Greenes: Ch 5, 6, 7
3	Knowledge Management for CDS, Part 1 [Paper assignment posted]	Greenes: Ch 10, 11, 12
4	Knowledge Management for CDS, Part 2	Greenes: Ch 28, 29
5	Humans and CDS: Cognitive Support and Usability	Greenes: Ch 3, 22
6	CDS System Implementation	Greenes: Ch 23, 25

7	Bayes' Theorem and Decision Theory	Berner: Ch2 (online)
8	Design and Structure of CDS Systems	Greenes: Ch 3, 5
9	(Recap and first draft of papers due)	none
-	Spring break	-
10	Representing Knowledge Part 1: Clinical Guidelines and Clinical Workflow	Greenes: Ch 16, 19
11	Representing Knowledge Part 2: Decision Rules and Engines, Ontologies, and Data Models	Greenes: Ch 15, 17, 18
12	Legal, Regulatory, and Financial Issues	Greenes: Ch 21, 24, 26
13	Emerging and Future Directions, Part 1: Public & Personal Health Decision Support (HIMSS week)	Greenes: 13, 14
14	Emerging and Future Directions, Part 2: Patient-Centered Decision Support and Beyond	Greenes: Ch 30
15	(Wrap-up and final draft of papers due)	none

TBD=to be determined

Evaluation and Assessment

Grades will be based on a weighted scale distributed as follow:

#	Assessment Method	Percent
1	Weekly Assignments	40%
2	Homework	30%
3	Papers	30%
	Total	100%

(1) Weekly Assignments: Each week students will be required to complete an assignment to demonstrate comprehension of course material as well as participation. Examples include: an online post and discussion of a recent news article involving CDS or a CDS system; critical analysis of a recent CDS peer-reviewed article; a quiz covering material from the weekly readings and topic narrative; or an interview with a clinician using CDS in the real-world. Assignments are due on the date and time listed in Canvas; generally, these will be due at 8:00am on Mondays. Students should pay close attention to due dates as some weeks will be different due to Spring Break, holidays, etc. Students **will not** receive credit for late assignments or failing to submit an assignment unless arrangements are made **prior** to the due date. Do not email your instructor on or after the due date to request an extension unless an accepted excuse is provided.

(2) Homework: Students will be periodically assigned tasks to complete that will require work beyond the timeframe of a single week. Students will usually have 2-3 weeks to complete the homework assignment. Homework may include tasks such as the analysis of CDS data extracted from real-world alert logs; development of CDS alert logic; establishing weights for a Bayesian network; execution of scripts for processing health care data or alerts; locating information on clinical guidelines; or generating reports on CDS system activity. Students will complete the assigned tasks then submit their results and/or a report detailing their results/experiences. Homework reports are due on the date and time listed in Canvas; these will be due at 8:00am on Mondays. Students should pay close attention to due dates as some weeks will be different due to Spring Break, holidays, etc. Late work will not be accepted unless an extension is granted in advance.

(3) Papers: Students will be asked to complete 1 paper during the course. The papers will focus students on researching a particular topic in the area of CDS, critically analyzing some aspect of CDS systems, and summarizing their analysis in a written form. Students will generally have most of the semester to complete a paper with the rough draft due before spring break. Papers are due on the date and time listed in Canvas; these will be due at 8:00am on Mondays. Students should pay close attention to due dates as some weeks will be different due to Spring Break, holidays, etc. Late work will be accepted but students will receive a penalty equal to or greater than a whole letter grade.

Note: Students are **strongly encouraged** to have their paper reviewed prior to submission by the IUPUI Writing Center. Students can receive up to three (3) 1-hour sessions each week with a mentor at the Writing Center throughout the semester to address writing skills. Students are encouraged to contact the Writing Center early in the semester to schedule time before time slots at the end of the semester are filled. English writing skills are very important to success in any career. Improper use of the English language will result in a loss of points in this course.

Grading Scale

The final grade will be a weighed composite of many smaller grades. This should create a fair result.

The conversion table from numerical format to letter grades is followed:

Grade	Percentage
A+	97-100
A	93-96
A-	90-92
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76

C-	70-72
D	60-69
F	0-59

Grading Principles and Policies

Students should review all grading forms that will be used by the instructor to grade projects, presentations, papers, and other assignments. If students want to see their grades at any time during the semester, they should contact the instructor by phone or email.

Criteria to evaluate written assignments:

Exceptional quality (not quantity): (90-100 %)

- Evident that individual has completed all requirements
- Demonstrates applied level of understanding through personal reflections
- Answer is well-developed and logically reasoned
- Provides original insights or responses; extends comments of others
- Supports and leads others in discussion; respects others and their ideas

Superior quality (not quantity): (80-89%)

- Evident that individual has completed all requirements
- Demonstrates applied level of understanding through personal reflections
- Answer is provided; logic may not be clear
- Provides original insights or responses
- Makes connections to what others say; respects others and their ideas

Satisfactory quality and quantity: (60-79 %)

- Evident that individual has completed all requirements
- Primarily consists of summary or paraphrasing of readings
- Answer is not fully developed; logic is not clear
- Contribution is primarily a response to others; minimal originality
- Is respectful of others and their ideas

Does not meet expectations: (< 60%)

- Not clear that individual has completed all requirements
- Only consists of summary or paraphrasing of readings
- Minimal effort put into answer
- Is not respectful of others and their ideas

Requirements not completed (0)

Late work

Assignments are due by the date and time posted in Canvas. Severe weather rarely results in cancellation of classes or changes in due dates/times of assignments. As such, previously assigned work will still be due as posted in Canvas. Please clarify with the instructor regarding due dates of future assignments.

Extensions

Extensions may be granted in the case of exceptional circumstances. You must discuss these circumstances with your instructor at least 24 hours before the assignment is due. (Note: Discussing the situation is not the same as merely informing your instructor.) In order for a late assignment to receive full marks, it must include a note from the instructor confirming the extension date. An instructor note, attached to your assignment, can include a printed copy of an e-mail exchange between instructor and student indicating that an extension has been granted. Medical reasons for a late assignment must be documented by a doctor's note. Under normal circumstances (according to university regulations) medical excuses must be presented promptly (within two weeks from the date of the illness).

Backup copies

Please keep an electronic copy and a hard copy of your final paper and presentation.

CODE OF CONDUCT

All students should aspire to the highest standards of academic integrity. Using another student's work on an assignment, cheating on a test, not quoting or citing references correctly, or any other form of dishonesty or plagiarism shall result in a grade of zero on the item and possibly an F in the course. Incidences of academic misconduct shall be referred to the Department Chair and repeated violations shall result in dismissal from the program.

All students are responsible for reading, understanding, and applying the *Code of Student Rights, Responsibilities and Conduct* and in particular the section on academic misconduct. Refer to *The Code > Responsibilities > Academic Misconduct*.
<https://studentcode.iu.edu/>

All students must also successfully complete the Indiana University Department of Education "How to Recognize Plagiarism" Tutorial and Test. You must document the difference between your writing and that of others. Use quotation marks in addition to a citation, page number, and reference whenever writing someone else's words (e.g., following the *Publication Manual of the American Psychological Association*). To detect plagiarism instructors apply a range of methods, including Turnitin.com.

Academic Misconduct:

1. **Cheating:** Cheating is an attempt to use or provide unauthorized assistance, materials, information, or study aids in any form and in any academic exercise or environment.
 - a. A student must not use external assistance on any "in-class" or "take-home" examination, unless the instructor specifically has authorized external assistance. This prohibition includes, but is not limited to, the use of tutors, books, notes, calculators, computers, and wireless communication devices.
 - b. A student must not use another person as a substitute in the taking of an examination or quiz, nor allow other persons to conduct research or to prepare work, without advanced authorization from the instructor to whom the work is being submitted.

- c. A student must not use materials from a commercial term paper company, files of papers prepared by other persons, or submit documents found on the Internet.
 - d. A student must not collaborate with other persons on a particular project and submit a copy of a written report that is represented explicitly or implicitly as the student's individual work.
 - e. A student must not use any unauthorized assistance in a laboratory, at a computer terminal, or on fieldwork.
 - f. A student must not steal examinations or other course materials, including but not limited to, physical copies and photographic or electronic images.
 - g. A student must not submit substantial portions of the same academic work for credit or honors more than once without permission of the instructor or program to whom the work is being submitted.
 - h. A student must not, without authorization, alter a grade or score in any way, nor alter answers on a returned exam or assignment for credit.
2. **Fabrication:** A student must not falsify or invent any information or data in an academic exercise including, but not limited to, records or reports, laboratory results, and citation to the sources of information.
 3. **Plagiarism:** Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged.
 - a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
 - b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
 1. directly quoting another person's actual words, whether oral or written;
 2. using another person's ideas, opinions, or theories;
 3. paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
 4. borrowing facts, statistics, or illustrative material; or
 5. offering materials assembled or collected by others in the form of projects or collections without acknowledgment
 4. **Interference:**^[SEP]A student must not steal, change, destroy, or impede another student's work, nor should the student unjustly attempt, through a bribe, a promise of favors or threats, to affect any student's grade or the evaluation of academic performance. Impeding another student's work includes, but is not limited to, the theft, defacement, or mutilation of resources to deprive others of the information they contain.
 5. **Violation of Course Rules:**^[SEP]A student must not violate course rules established by a department, the course syllabus, verbal or written instructions, or the course materials that are rationally related to the content of the course or to the enhancement of the learning process in the course.
 6. **Facilitating Academic Dishonesty:**^[SEP]A student must not intentionally or knowingly help or attempt to help another student to commit an act of academic misconduct, nor allow another student to use his or her work or resources to commit an act of misconduct.

CAMPUS POLICIES

1. **Administrative withdrawal (undergraduate only):** Students must participate in all class discussions and conscientiously complete all required course activities and/or assignments. If a student is unable to attend, participate in, or complete an assignment on time, the student must inform the instructor. If a student misses more than half of the required activities within the first 25% of the course without contacting the instructor, the student may be administratively withdrawn from this course. Administrative withdrawal may have academic, financial, and financial aid implications. Administrative withdrawal occurs after the full refund period, and a student who has been administratively withdrawn is ineligible for a tuition refund. <https://studentcentral.iupui.edu/register/administrative-withdrawal.html>
2. **Counseling and Psychological Services (CAPS):** Students seeking counseling or other psychological services should contact the [CAPS office](mailto:capsindy@iupui.edu) at 274-2548 or capsindy@iupui.edu.
3. **Course policies:** Several campus policies governing IUPUI courses may be found at the following [link: http://registrar.iupui.edu/course_policies.html](http://registrar.iupui.edu/course_policies.html)
4. **Disabilities policy:** All qualified students enrolled in this course are entitled to reasonable accommodations for a disability. Notify the instructor during the first week of class of accommodations needed. Students requiring accommodations register with Adaptive Educational Services (AES) and complete the appropriate forms from AES before receiving accommodations. The AES office is located at UC 100, Taylor Hall (Email: aes@iupui.edu, Tel. 317 274-3241). For more information visit <http://aes.iupui.edu>. For ADA resources visit <https://accessibility.iu.edu/ada/>. For ADA policies visit <https://policies.iu.edu/policies/ua-02-americans-disability-act/>.
5. **Education and Title VI:** IUPUI nurtures and promotes “a campus climate that seeks, values, and cultivates diversity in all of its forms and that provides conditions necessary for all campus community members to feel welcomed, supported, included, and valued” (IUPUI Strategic Initiative 9). IUPUI prohibits “discrimination against anyone for reasons of race, color, religion, national origin, sex, sexual orientation, marital status, age, disability, or veteran status” (Office of Equal Opportunity). Title VI of the Civil Rights Act of 1964 protects people from discrimination based on race, color, or national origin in programs or activities that receive Federal financial assistance. Programs and activities that receive ED funds must operate in a nondiscriminatory manner, including admissions, recruitment, financial aid, academic programs, student treatment and services, counseling and guidance, discipline, classroom assignment, grading, vocational education, recreation, physical education, athletics, housing, and employment, if it affects those who are intended to benefit from the Federal funds. <http://www2.ed.gov/about/offices/list/ocr/docs/hq43e4.html>
6. **Emergency preparedness:** Know what to do in an emergency to be protected and to protect others. For more information, visit the emergency management website at <http://protect.iu.edu/emergency>.
7. **No class attendance without enrollment:** Only those who are officially enrolled in this course may attend class unless enrolled as an auditor or making up an incomplete by prior arrangement with the instructor. This policy does not apply to

those assisting a student with a documented disability, serving in an instructional role, or administrative personnel.

<https://facultystaffcentral.iupui.edu/enrollment/index.html> Children may *not* attend class with their parents, guardians, or childcare providers.

8. **Religious holidays:** IUPUI respects the right of all students to observe their religious holidays and will make reasonable accommodation, upon request, for such observances. Students seeking accommodation for religious observances must submit a [request form](#) to the course instructor by the end of the second week of the semester. For information visit.
9. **Sexual misconduct:** One of the instructor's responsibilities is to create a safe learning environment. IU does not tolerate sexual harassment or violence, which are prohibited under Title IX and the [sexual misconduct policy](#). The university can help students subjected to sexual misconduct. To seek help, obtain information and resources, or speak to someone confidentially, visit <https://stopsexualviolence.iu.edu/>. Federal regulations and University policy require the instructor to convey promptly any information about potential sexual misconduct to IUPUI's Deputy Title IX Coordinator or IU's Title IX Coordinator to ensure appropriate measures are taken and resources are offered. To protect a student's privacy all involved will only share information with those who need to know to ensure the university can respond and assist.
10. **Student advocate:** The Student Advocate assists students with personal, financial, and academic issues. The Student Advocate is in the Campus Center, Suite 350, and may also be contacted at 317 274-4431 or studvoc@iupui.edu. For more information visit <http://studentaffairs.iupui.edu/advocate>.

SCHOOL POLICIES AND GUIDELINES

1. **Civility:** To maintain an effective and inclusive learning environment, it is important to be an attentive and respectful participant in lectures, discussions, groupwork, and other classroom exercises. Thus, unnecessary disruptions should be avoided, such as ringing cell phones, engagement in private conversations, and other unrelated activities. Cell phones, media players, or any noisy devices should be turned off during a class. Texting, web surfing, and posting to social media are generally not permitted. Laptop use may be permitted if it is used for taking notes or conducting class activities. Students should check with the instructor about permissible devices in class. Profanity or derogatory comments about the instructor, fellow students, invited speakers or other classroom visitors, or any members of the campus community shall not be tolerated. A violation of this rule shall result in a warning and, if the offense continues, possible disciplinary action.
2. **Communication:** For classroom-based courses, the instructor or teaching assistant should respond to emails by the end of the next class or, for online courses, within two Indiana University working days, which excludes weekends and holidays. The instructor should provide weekly office hours or accept appointments for face-to-face, telephone, or teleconferenced meetings, and announce periods of extended absence in advance.
3. **Course evaluations:** Course evaluations provide vital information for improving the quality of courses and programs. Students are urged to complete one course and

instructor evaluation for each section in which they are enrolled at the School of Informatics and Computing with the following exceptions: (a) The student has withdrawn from the course; (b) fewer than five students are enrolled in the section (in which case maintaining anonymity is difficult); and (c) the section is a laboratory that must be taken with a course having a different section number. Course evaluations are completed at <https://soic.iupui.edu/app/course-eval/>. Course evaluations are typically open from the eleventh week. Course evaluations are anonymous, which means that no one can view the name of the student completing the evaluation. In addition, no one can view the evaluation itself until after the instructor has submitted the final grades. In small sections, demographic information should be left blank, if it could be used to identify the student.

4. **Email:** Indiana University uses the student's IU email account as an official means of communication, and students should check it daily. Although the student may have IU email forwarded to an outside email account, the student should email faculty and staff from the student's IU email account.
5. **Right to revise:** The instructor reserves the right to make changes to this syllabus as necessary and, in such an event, will notify students of the changes immediately.

MISSION STATEMENT

The Mission of IUPUI is to provide for its constituent's excellence in

- Teaching and Learning;
- Research, Scholarship, and Creative Activity; and
- Civic Engagement.

With each of these core activities characterized by

- Collaboration within and across disciplines and with the community;
- A commitment to ensuring diversity; and
- Pursuit of best practices.

IUPUI's mission is derived from and aligned with the principal components—Communities of Learning, Responsibilities of Excellence, Accountability and Best Practices—of Indiana University's Strategic Directions Charter.

STATEMENT OF VALUES

IUPUI values the commitment of students to learning; of faculty to the highest standards of teaching, scholarship, and service; and of staff to the highest standards of service. IUPUI recognizes students as partners in learning. IUPUI values the opportunities afforded by its location in Indiana's capital city and is committed to serving the needs of its community. Thus, IUPUI students, faculty, and staff are involved in the community, both to provide educational programs and patient care and to apply learning to community needs through service. As a leader in fostering collaborative relationships, IUPUI values collegiality, cooperation, creativity, innovation, and entrepreneurship as well as honesty, integrity, and support for open inquiry and dissemination of findings. IUPUI is committed to the personal and professional development of its students, faculty, and staff and to continuous improvement of its programs and services.