# Syllabus 2020 SPRING CS 421-001 FORMAL METHODS

 CRN: 10370, CREDITS: 3

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 CRN: 10374, CREDITS: 3

#  General Information

## Contact Your Instructor

 **Name:** R.B.Abhyankar

**Email:** R.B.Abhyankar@indstate.edu

**Phone:** 812-237-8126

**Office:** Root Hall, A-138C

## Lecture, Exam, Office Hours

 **Lecture:** TR : 9:30 am to 10:45 am Root Hall A-019

**Final Exam:** For the Final Exam Schedule please go to:

 https://www.indstate.edu/registrar/faculty-staff-resources

**Instructor Office Hours:** 9:00 am to 10:00 am Mondays, Fridays and also by appointment.

**Website**: There is a Blackboard web site for the course.

## Prerequisites

A grade of C or better in CS 202, and CS 303, or consent of instructor.See <http://cs.indstate.edu/info/courses.php>

 A 500 level course cannot be taken as part of the MS program if you have completed the same 400 level course at ISU. For example, if you completed CS 470 as an undergrad, you **cannot** take CS 570 as an MS student and count it towards the degree.

## Recommended and/or Required Text

"Symbolic Logic and Mechanical Theorem Proving" by C-L Chang and R C T Lee (Academic Press, 1973, ISBN-13: 978-0121703509)

## Course Announcements

Announcements regarding the course will be made both during class and via email to your @sycamores.indstate.edu email address. You should regularly check this email account or have it forwarded to an account that you check regularly.

## Classroom conduct

You may not use cell phones, iPods/music players, etc. during class. You should be civil and respectful to both the instructor and your classmates, and you should arrive to class a few minutes before the scheduled lecture so you are ready for lecture to begin on time. You may use your computer during class if you are using it to follow along with the examples that are being discussed. You may not check email, facebook, work on other courses, etc. during class.

# Course Description

The official description of this course from the catalog is :

Elements of formal logic; various approaches to automation including resolution; restrictions and search methods; inductive theorem-proving; Knuth-Bendix completion; Boyer-Moore theorem-prover; applications.

# Course Outline

Propositional Logic: Syntax and Semantics; Propositional Resolution., Applications.

First Order Logic: Syntax and Semantics; Unification, Resolution, Applications.

Disproofs. Proof Calculators, Proof Checkers, Theorem Provers, Model Builders, SAT and

SMT Solvers. Combinators, Fixed Point Combinators. Computer-aided proofs in combinatory logic. Reasoning with Equality, Inductive Theorem Proving, Hoare Logic and Program Proofs.

Normal Content

Topics are covered roughly in the order stated in the course outline. The applications of propositional resolution usually covered are the Knights and Knaves problems, and the Superman puzzle. Applications of First Order Logic covered are the Knights and Knaves Problems, Logic Circuit Design, Monkey and Banana plan generation problem, question answering, Logical Foundations of Database Theory. Use of theorem provers is covered. Disproofs and production of counter models are covered and illustrated using model builders, SAT and SMT solvers. Reasoning with equality is covered using equality theories and paramodulation. Inductive proofs are covered in inductive theories, such as integers and lists.

Finally, Hoare Logic is introduced to prove correctness of Imperative Programs. Tool support for Hoare Logic is surveyed.

# Learning Outcomes

After completing the course, the student should be able to apply logical methods to problems in Computer Science.

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# Expected Amount of Work

If you take this class seriously and get what you should out of it, some weeks you will likely be spending around 4 **hours/week** or more on the class. The students who get A’s in their CS courses and have an easy time finding jobs do spend this much time on this course. Not everyone would need to spend this much time and not all weeks will be the same, but you should plan on putting in whatever time it takes.

# Grading and Assignments

The students of this course have the following responsibilities: read assigned readings before lecture, attend lecture, complete homework assignments, take in-class quizzes, take exams, and complete a project.

DISTRIBUTION OF POINTS

 Pop Quizzes: 10 %

 Assignments: 40 %

 Final Exam: 50 %

 Pop quizzes may be given at any time in class, without prior notice.

## CS Course Policies

Note that this course follows all standard CS course policies. In particular check the CS course policies related to - cheating/plagiarism, attendance, missing exams. See <http://cs.indstate.edu/info/policies.html> for details.

## Late Homeworks

Assignments submitted late may not earn full credit due.

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## Start Homeworks Early

We suggest attempting a homework assignment the day it is given, or the day after, so that if you have a problem you can ask early. If you continue to have problems in trying to complete the assignment, you will have time to ask again. Many of the homework assignments require thought and problem solving, which takes “time on the calendar” not just “time on the clock”. By that we mean that spending two hours on 3 consecutive days may be more productive than trying to spend 6 hours at once on the assignment.

## Grade Cutoffs

GRADING SCALE:

Percentage Minimum Grade

97 and up A +

94-96 A

90-93 A -

87-89 B +

84-86 B

80-83 B -

77-79 C +

74-76 C

70-73 C -

67-69 D +

64-66 D

60-63 D -

59 and below F

Our goal is that the different grades have the following rough meaning.

**A+/A**
You can do *all* the assignments *on your own*.

**B+/A-**You understand nearly everything, and should be all set to use this knowledge in other courses or in a job.

**B-/B**

Most things you understand very well and a few you might not (more towards the former for a B and more towards the latter for a C).

**C/C+**
Learned enough and have the minimum skills to move on in the subject.

**D+/C-**
You did put some effort in, and understand many things at a high level, but you haven’t mastered the details well enough to be able to use this knowledge in the future.

**D-**

Students will normally *not* get an F if - you attend 80% of the lectures, complete some of the assignments up through the end of the course, and get nearly half of the problems on the final exam correct.

**F**
Normally, students that get an F simply stopped doing the required work at some point.

# Blackboard

The course has a blackboard site. Click [here](http://blackboard.indstate.edu) to go to blackboard. You should see this course listed under your courses for the current term.

# Academic Integrity

Follow the standard CS course policies in terms of what is and is not allowed on assignments: <http://cs.indstate.edu/info/policies.html>

Please ask the instructor if you have doubts about what is considered cheating in this course.

# Special Needs / Student Disabilities

Indiana State University recognizes that students with disabilities may have special needs that must be met to give them equal access to college programs and facilities. If you need course adaptations or accommodations because of a disability, please contact us as soon as possible in a confidential setting either after class or in my office. All conversations regarding your disability will be kept in strict confidence. Indiana State University's Student Support Services (SSS) office coordinates services for students with disabilities: documentation of a disability needs to be on file in that office before any accommodations can be provided. Student Support Services is located on the lower level of Normal Hall in the [Center for Student Success](http://www.indstate.edu/services/student-success/cfss) and can be contacted at 812-237-2700, or you can visit the ISU website under A-Z, [Disability Student Services](https://www.indstate.edu/services/student-success/cfss/student-support-services/disability-student-services) and submit a Contact Form. Appointments to discuss accommodations with SSS staff members are encouraged.

Once a faculty member is notified by Student Support Services that a student is qualified to receive academic accommodations, a faculty member is obligated to provide or allow a reasonable classroom accommodation under ADA.

# **Disclosures Regarding Sexual Misconduct**

*Standard language included in the syllabi for ISU courses.*

Indiana State University fosters a campus free of sexual misconduct including sexual harassment, sexual violence, intimate partner violence, and stalking and/or any form of sex or gender discrimination. If you disclose a potential violation of the sexual misconduct policy I will need to notify the Title IX Coordinator. Students who have experienced sexual misconduct are encouraged to contact confidential resources listed below. To make a report or the Title IX Coordinator, visit the Equal Opportunity and Title IX website:<http://www.indstate.edu/equalopportunity-titleix/titleix>.

The ISU Student Counseling Center – HMSU 7th Floor | 812-237-3939 | [www.indstate.edu/cns](http://www.indstate.edu/cns)

The ISU Victim Advocate – Trista Gibbons, trista.gibbons@indstate.edu

HMSU 7th Floor | 812-237-3939 (office) | 812-230-3803 (cell)

Campus Ministries - United Campus Ministries | 812-232-0186

 <http://www2.indstate.edu/sao/campusinistries.htm>

[www.unitedcampusministries.org](http://www.unitedcampusministries.org/) | ucmminister2@gmail.com

321 N 7th St., Terre Haute, IN 47807

For more information on your rights and available resources<http://www.indstate.edu/equalopportunity-titleix/titleix>