CS 23022 Discrete Structures  
Spring 2021  
Remote Course using Zoom  
Invitation sent in advanced by email  
Time: Tuesdays, Thursdays 9:15 AM – 10:30 AM

Instructor: Professor Arvind Bansal  
Office: Remote contact using Zoom  
Phone: 330.672.9035  
Email: akbansal@kent.edu (official);  
Email for assignment and other questions: arvindbansalohio@yahoo.com.  
Please avoid my university email for assignment related questions as it gets cluttered due to large class.

Office hours: 11 AM – 12 PM Tuesdays and Thursdays (Remote Zoom meeting); or by appointment  
Delivery: Traditional (75 minutes X two times / week in class)  
First Class on January 19, 2021  
Final Examination: May 12, 2021

Graders: TBA  
Tutors: TBA

Motivation  
Discrete Structure is the heart and soul of computer modeling of the real world problem. The real world problems are modeled using Boolean logic, combinatorics, probabilistic reasoning, and logical inference. Discrete Structures interfaces real world problem to abstract computational description of the problem that can be programmed. It has application in all the courses you will learn such as data structures, programming languages, operating system, analysis of algorithm, computer networks, artificial intelligence, databases, game playing etc.

Course Description  
Discrete structures for computer scientists with a focus on: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, application and modeling.

- Specific topics include:

  **First Midterm**
  1. Propositional and predicate logic (Chapter 1 – sections 1.1 to 1.4, part 1.5)  
  2. Boolean algebra and Karnaugh maps (Chapter 12 – sections 12.1 to 12.3)  
  3. Set theory and functions (Chapter 2: sections 2.1 to 2.3, 2.5 )  
  4. Sequence representation: inductive and recursive, series summation (Sections 2.4)  
  5. Information representation in computers (Section 4.2)
**Second Midterm**
6. Logical inferencing and proof techniques (Chapter 1 – Sections 1.6 & 1.7)
7. Mathematical induction and recursion (Chapter 5 sections 5.1 to 5.3; Sections 3.1, 8.1)
8. Counting and pigeonhole principle (Chapter 6: sections 6.1 and 6.2)
9. Combinatorics and their applications (Chapter 6: sections 6.3 & 6.4)

**Final Midterm**
10. Trees properties and traversal (Chapter 11: sections 11.1 to 11.4 and )
11. Probability theory and distribution (Chapter 7: sections 7.1 to 7.4)
12. Matrix-based computations (Section 2.6)
13. Graphs and application (Chapter 10: sections 10.1 to 10.3)
14. Relations and their applications in databases (Chapter 9: sections 9.1 to 9.6)
15. Finite State Automata and their applications. (Chapter 13: sections 13.2 and 13.3)
16. Grammars and their use in programming languages (Chapter 13: section 13.1 and 13.4)

All assignments have due dates. **Late assignments for the individuals will not be accepted to maintain the schedule.** Assignments may only be extended for the whole class if the schedule permits and there are unexpected conditions for the whole class.

**Prerequisites:** Minimum C grade in MATH 11009 or MATH 11010 or Math 11022, or ALEKS score of 78.

**Course Learning Outcomes**
By the end of the course, Students will learn useful Mathematics for CS majors, including logic, sets, functions, relations, Boolean algebra, probability:
1. Basics of mathematical reasoning and different proof techniques
2. Boolean algebra and its applications in mathematical reasoning and circuit design
3. Inductive and recursive modeling of the number sequences and reasoning
4. Combinatorial analysis and different counting techniques
5. Probability and its applications
6. Discrete structures such as graphs, trees, matrices, their modeling and applications.
7. Relations and its application in databases
8. Finite State Automata, Language grammars and their applications

**Learning Materials and Textbook**
  o You can request the seventh edition of this book through Kent State University Libraries: [http://kentlink.kent.edu/record=b3199805?](http://kentlink.kent.edu/record=b3199805?)
  o Seventh edition of this book will be available in University Bookstore for rental.
  o E-Books are available over the Internet for under $ 30 from many websites
You must rent/buy the book for better comprehension of the material. It is strongly recommended.

- The slides of the teaching material will be available on the Blackboard website for the course.
- The remote lecture will be recorded and placed on the Kent State Google drive. It will be shared with you using a download link. This will help those who missed a class or those who do not have proper Internet link or slow Internet link.

Communication Policy

1. Email course questions and personal concerns, including grading questions, to me privately using your @kent.edu email. Do NOT submit posts of a personal nature to the discussion board.
2. Email will be checked at least twice per day Monday through Friday; Saturday and Sunday, email is checked once per day. During the weekdays, I will respond to all emails within 24 hours; on weekends and holidays, allow up to 48 hours. If there are special circumstances that will delay my response, I will make an announcement to the class.
3. For questions related to technology, please contact: 330-672-HELP for 24/7 support.
4. **Zoom class meeting protocols:** Zoom will be started at 9:00 AM. The link to join Zoom will be sent at 8:45 AM by email. It will have a class password. Please use the password Please join the session before 9:15 AM to utilize the class time effectively. Please keep your video and microphone ‘off’ to preserve bandwidth. After joining, please say ‘Hi everyone’ or ‘Hi Dr. Bansal’ in the chatbox. This will be your attendance. Missing the chatbox during the class session will disqualify you for your attendance for that day. During the class session, questions can be asked either using chatbox or using the microphone. If you use microphone, then unmute your microphone when you ask the question, and mute it immediately after you have finished the question.

Assignments and Grades

A detailed breakdown of course assignments and due dates by lesson module is available as a separate .pdf document that can be accessed in Bb Learn by clicking on the **Syllabus & Course Schedule** link in the course menu. Projected grades will be available throughout the semester for you to assess your current performance, which will help you to improve your final grade.

Attendance grade changes after every class as the attendance is entered. Please do not get panicked, if in the first few days, you miss a class and attendance grade falls drastically. In the beginning, only few classes would have been offered. Hence, the effect appears drastic. As the number of classes improves so does the effect of attended classes.

Writing Assignments

*There will be six assignments: two assignments before every exam.* Students should submit all writing assignments using blackboard. Homework must be turned in by the midnight in PDF format on due date, preferably typed. However, scanned readable assignments (or partial assignments) in good handwritten format are acceptable. When required, you should use special symbols of Microsoft word or other editing software. A copy of a text containing such symbols will be provided to you along with the assignment that you can use to cut and paste.
You will need to devote a considerable amount of time to homework. You may discuss the homework with other students, but you must write your solutions independently. Study groups should limit their size to 2-3 so that each collaborator can participate in solution. Solutions must be developed independently by you, and not copied from any external sources (see the section on cheating and plagiarism) or the fellow group member’s answers. You are encouraged to use Internet for understanding the concepts and explanations. **Do not copy any solution.** It is for your good only. If you do not learn, you will perform poorly in the exam, and more weight is given to the exams.

**Late and Make-up Work Policy:** Attendance is a **mandatory** course requirement. Attendance grades are nonlinear, and favor students attending most of the classes. Those attending 90% or more of the classes will get prorated up to 2% extra bonus in the total grade. **Students attending less than 70% of the classes without any medical or family emergency will get a zero in the attendance part of the grade.**

*Those students who do not attend the class due to other projects in other courses during the last two weeks of the semester will be penalized 50% of the attendance grades, and their assignments during that period would not be accepted because a student who does not have time to attend an hour-long class is presumed to use other means to finish the assignment. If you miss a class, you must use remote meetings with instructor during remote office hours / grader during remote office hours / tutor using their preferred means of communication to learn and show that you understand the material before that part of the assignment is graded for you. A written note or a direct email by the grader/tutor that you understand the material will allow the relevant problems to be graded.*

Missed tests, homework, and attendance are only excused if absence was essential such as medical and/or family emergencies and are fully documented. **Unexcused late homework is not accepted.** Class extensions on homework, if any, will be announced in class. They may also be announced by email and at the blackboard. You will be allowed to submit each assignment up to four times on the Blackboard. After that, Blackboard will lock.

According to the university, some students are misusing COVID 19 to use unfair means and cheating during the midterms and the final exam. Please be advised, that is a very serious offense. In the case, I suspect anyone, he/she will be asked to take an oral test using Zoom on the similar material on the copied material in addition to cheating policy. For the suspected case, the exam score will be decided by the face-to-face oral test. **Please do not follow unfair means.**

**Assignment Distribution and Grading Scale**

<table>
<thead>
<tr>
<th>Method of Assessment</th>
<th>Weights</th>
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<tbody>
<tr>
<td>Participation and attendance</td>
<td>20%</td>
</tr>
<tr>
<td>Assignments (5% X 6)</td>
<td>30%</td>
</tr>
<tr>
<td>Exam1</td>
<td>15%</td>
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<tr>
<td>Exam2</td>
<td>15%</td>
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<tr>
<td>Exam3 (May 7, 2020)</td>
<td>20%</td>
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</table>
At any point, the percentage in total will show the overall percentage. Using the grade table, you will be able to estimate your running grade.

**Final Grading Scale**

<table>
<thead>
<tr>
<th>Scale:</th>
<th>&lt; 55%</th>
<th>55%</th>
<th>58%</th>
<th>62%</th>
<th>65%</th>
<th>68%</th>
<th>72%</th>
<th>75%</th>
<th>78%</th>
<th>82%</th>
<th>85%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade:</td>
<td>F</td>
<td>D</td>
<td>D+</td>
<td>C-</td>
<td>C</td>
<td>C+</td>
<td>B-</td>
<td>B</td>
<td>B+</td>
<td>A-</td>
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<tr>
<td>GPA:</td>
<td>0.00</td>
<td>1.00</td>
<td>1.30</td>
<td>1.70</td>
<td>2.00</td>
<td>2.30</td>
<td>2.70</td>
<td>3.00</td>
<td>3.30</td>
<td>3.70</td>
<td>4.00</td>
</tr>
</tbody>
</table>

**University Policies**

Students are required to be aware of and follow all general and academic policies established by Kent State University. A list of the general academic policies is listed on the Kent State University Policy Register, which can be found in the University policies section of the Getting Started in Your Online Course link within the Start Here folder. Specific policies related to the successful completion of this online course can be located and reviewed in your Blackboard Learn course.

**Registration Requirement**

The official registration deadline for this course is . University policy requires all students to be officially registered in each class they are attending. Students who are not officially registered for a course by published deadlines should not be attending classes and will not receive credit or a grade for the course. Each student must confirm enrollment by checking his/her class schedule (using Student Tools in FlashFast) prior to the deadline indicated. Registration errors must be corrected prior to the deadline. **The last day to withdraw before a grade of "W" is assigned is January 25, 2021.** No approval is necessary before this date. **The last day to withdraw with a grade of "W" assigned is Sunday, March 29, 2021.**

**Students with Disabilities**

University policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact the instructor at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through Student Accessibility Services (contact 330-672-3391 or visit www.kent.edu/sas for more information on registration procedures).

The Blackboard accessibility statement can be found in the University policies section of the Getting Started in Your Online Course link within the Start Here folder.

**Code of Conduct in the Class**

The following protocols will be strictly followed to make the class conducive for learning.

1. Students must come to the class before the class starts. However, if due to some unforeseen reason, they are delayed they can enter the class. Regular delays are strongly discouraged. It is the student’s responsibility to cover the material they have missed.
2. **No food or drinks will be allowed in the class** unless there is an established medical condition certified by the physician that forces the student to do otherwise. In case of medical conditions, the student should seek prior permission from the instructor before the class starts.

3. **The students will not get into any form of altercation or cross-talks.** All questions will be asked while maintaining the decorum in the class. During the class, the interaction will be between the student and teacher only. Anyone showing any form of violent behavior (such as abusive language or loud voice) in the class will be asked to immediately leave the class, and his case will be reported to the department administration for further action.

4. There will be complete radio silence during the class that **means all the cell phones and/or PDAs will be turned off** during the class unless there is an emergency situation and instructor has already given permission for the cell phone to be on for the specific student. Even in the case of emergency, student will have to go out to receive the call.

5. **Nobody will be allowed to surf the Internet or check e-mails or listen to music or perform any form of activity involving PDAs or cell phones while in the class.** PDAs will be turned off and put away in the backpack.

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**Plagiarism and Academic Integrity**

**Academic Integrity**

Student-teacher relationships are built on trust. Students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments which students turn in are their own effort. Acts that violate this trust undermine the educational process. Academic dishonesty in any form will be penalized up to assigning grade F, and reporting to the department for university action.

**Academic Dishonesty in Homework Assignments and Programming Projects**

Learning is encouraged, and cheating is discouraged. Unfortunately, there is a fine line between where learning ends and cheating starts. You are encouraged to get involved in group study to understand the concepts if you do not know how to solve a problem. However, individual problems must be solved by individual students. If the grader finds that two answers are very similar: wordings are very similar and/or sentence structures are very similar, then it is a case of copying. Cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied.

You will be given a warning after the first case of academic dishonesty, and your score in that assignment will be 0. If you repeat the practice of dishonesty, your final grade will be lowered by one scale, and your activity will be sent to assistant chair for the record. For example, if you were getting a ‘B’ after the final calculation, you will be awarded only a ‘C’. After the third incidence, you will be given an ‘F’, and your case will be reported to the department for further disciplinary action.

University policy 3-01.8 deals with the problem of academic dishonesty, cheating, and plagiarism. None of these will be tolerated in this class. The sanctions provided in this policy will be used to deal with any violations. If you have any questions, please read the policy at [http://www.kent.edu/policyreg/policydetails.cfm?customel_datapageid_1976529=2037779](http://www.kent.edu/policyreg/policydetails.cfm?customel_datapageid_1976529=2037779) and/or ask.

According to the university policy, any case of suspicious activity will be reported to the university. **Taking any picture or text from the Internet or book is a serious case of plagiarism.**
"Cheat" means to intentionally misrepresent the source, nature, or other conditions of academic work so as to accrue undeserved credit, or to cooperate with someone else in such misrepresentation. Cheating includes, but is not limited to:

- Obtaining or retaining partial or whole copies of examinations, tests or quizzes before these are distributed for student use;
- Using notes, textbooks or other information in examinations, tests and quizzes, except as expressly permitted;
- Obtaining confidential information about examinations, tests or quizzes other than that released by the instructor;
- Securing, giving or exchanging information during examinations;
- Presenting data or other material gathered by another person or group as one's own;
- Falsifying experimental data or information;
- Having another person take one's place for any academic performance without the specific knowledge and permission of the instructor;
- Cooperating with another to do one or more of the above;
- Using a substantial portion of a piece of work previously submitted for another course or program to meet the requirements of the present course or program without notifying the instructor to whom the work is presented; and
- Presenting falsified information in order to postpone or avoid examinations, tests, quizzes, or other academic work.

'Plagiarize' means to take and present as one's own a material portion of the ideas or words of another or to present as one’s own an idea or work derived from an existing source without full and proper credit to the source of the ideas, words, or works. As defined, plagiarize includes, but is not limited to:

- The copying of words, sentences and paragraphs directly from the work of another without proper credit;
- The copying of illustrations, figures, photographs, drawings, models, or other visual and nonverbal materials, including recordings of another without proper credit; and
- The presentation of work prepared by another in final or draft form as one's own without citing the source, such as the use of purchased research papers.

Academic Sanctions (from Section D). The following academic sanctions are provided by this rule for offenses of cheating or plagiarism. Kent campus instructors shall notify the department chairperson and the student conduct office each time a sanction is imposed. Regional campus instructors shall notify the regional campus dean and the student conduct officer each time a sanction is imposed. Regional campus student conduct officer shall notify the Kent student conduct office each time a sanction is imposed by a regional campus Instructor. The following academic sanctions are provided by this rule for offenses of cheating or plagiarism. In those cases the instructor may:

- Refuse to accept the work for credit; or
- Assign a grade of "F" or zero for the project, test, paper, examination or other work in which the cheating or plagiarism took place; or
- Assign a grade of "F" for the course in which the cheating or plagiarism took place; and/or;
• Recommend to the department chair or regional campus dean that further action specified in the rule be taken. The department chairperson or regional campus dean shall determine whether or not to forward to the academic dean or to the vice president for the extended university a recommendation for further sanction under this rule.

Procedures for invoking sanctions (from Section E). Academic administrative procedures pertaining to paragraph (D)(1)(a) of this rule. In the event that an instructor determines that it is more probable than not that a student in a course or program under the instructor’s supervision has presented work for university credit which involves an act of cheating, plagiarism or cooperation in either, then the instructor shall:
• Inform the student as soon as is practical, in person or by mail, of the belief that an act of cheating or plagiarism has occurred. If the student cannot be reached in a reasonable period of time, the instructor may proceed with sanctions, notifying the student in writing as promptly as possible of the belief and the procedural steps the instructor has taken.
• Provide the student an opportunity to explain orally, in writing, or both, why the student believes the evaluation of the facts is erroneous.
• If the explanation is deemed by the instructor to be inadequate or if no explanation is offered, the instructor may impose one of the academic sanctions listed in paragraph (D)(1)(a) of this rule. Where appropriate, the instructor may recommend the imposition of academic sanctions listed in paragraph (D)(1)(b) of this rule. In addition, the instructor may refer the matter to the dean of the college, campus, or school in which the student is enrolled for imposition of academic sanctions listed in paragraph (D)(1)(b) of this rule.
• The instructor shall notify the office of judicial affairs of the circumstances and action taken. Such notification will be used as background information in the event that formal conduct charges are initiated against the student.
• The instructor shall inform the student in writing of the right to appeal, and the procedure to follow.
• The instructor shall keep the evidence of cheating or plagiarism in a secure place and provide it upon request to any appeals officer or the conduct officer. The instructor shall provide copies on request to the student at the student's expense.
• The instructor shall cooperate with academic and student conduct personnel in any appeal of the decision, and/or in adjudication of any disciplinary proceedings.

For more information see the Kent State policy on plagiarism in the University policies section of the Getting Started in Your Online Course link within the Start Here folder.

**Student Survey of Instruction (SSI)**
Starting this semester, the end of the semester evaluation of the instruction has gone online. You must login on the website [https://ssi.kent.edu/](https://ssi.kent.edu/), and fill out the evaluation positively by **Thursday, April 30, 2021**.

**Subject to Change Statement**
The syllabus and course schedule may be subject to change due to unavoidable circumstances such as instructor’s sickness, unexpected university closure etc. Changes will be communicated via email or the Blackboard Learn announcement tool. It is the responsibility of students to check email messages and course announcements to stay current.