GOVERNORS STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES
DIVISION OF SCIENCE
COURSE SYLLABUS

COURSE TITLE: Discrete Structures

COURSE NUMBER: CPSC 438
CREDIT HOURS: 3
PROFESSOR: Winfried Karl RUDLOFF, Ph. D., Dr. h.c.
Senior Fellow, The International Institute for Advanced Studies in Systems Research and Cybernetics (IIAS)
Distinguished Professor of Internet-Based Global Education, IIAS
E-MAIL: wrudloff@govst.edu
WEBSITE: http://www3.govst.edu/ wrudloff/wkr.htm
OFFICE: ITS Room 148
OFFICE HOURS: By appointment only
SEMESTER: Fall 2011

RATIONALE AND COURSE DESCRIPTION:

Discrete Structures is a branch of modern Mathematics that has become one of those multi-disciplinary sciences which have strong overlap to computer science, its theories, and its applications. Specifically, Boolean algebra which is based on true-false, yes-no, on-off logic, is a part of discrete structures that is quite appropriate for the binary basic mechanism inherent in digital computers. Thus, both, hardware and software are strongly influenced by binary logic as is reflected in switching circuits, logical gates, and in conditional (true or false) statements of modern programming languages, etc.

This course develops two parallel approaches to discrete mathematics: For one, the lecture is designed to discuss the fundamentals of discrete structures as it applies to computer science and the development of hardware and software systems.

The second part of this course is devoted to the practical application of the concepts: The students, under the guidance of the professor, will learn to tackle mathematical problems that apply to the binary logic of digital computers in terms of their hardware as well as of software.

Since mathematics, in its concept, is a rather abstract language, a student's success in this course is strongly based on getting familiar with the symbolism of this science which implies quite some effort of rote learning as is the case with learning a foreign language. Such approach is best accomplished by solving selected problems which are provided in the text book. Thus, during the second part of the lecture, a seminar-type practicum is planned where the students can discuss the problems within the context of the lecture material.

LEARNING OBJECTIVE:

The main objective of this course is to provide the students with an understanding of the principles of discrete structures, and the solution of problems in computer science that are based on discrete mathematics.

PREREQUISITES:

An open mind, persistence when it comes to solving problems, and a desire to learn about the language of mathematics that is universal. Also, MATH320 and MATH325.
TOPICS:

The Symbolism of Logic
Sets and Functions as fundamental building blocks of discrete structures
The binary System and Boolean algebra, and their pertinence to computers
Induction and Recursion in relation to computer languages
Algorithms as a precise description of the path in which problems can be solved
The theory of graphs and its application to computer science
Trees and computer science and its languages.

TEXTBOOKS:

Required: Hein, James L.; Discrete Structures, Logic, and Computability, 2010

ACTIVITIES:

The lectures are primarily oriented around the required text and pertinent handouts. However, STUDENTS WILL BE RESPONSIBLE FOR ALL MATERIAL COVERED IN CLASS REGARDLESS WHETHER IT IS IN THE TEXTBOOK OR NOT. Students are expected to approach the material of this course with an attitude of persistence where rote learning is reinforced by an active participation in problem solving. They should develop an independent attitude towards the development of a project consisting of pertinent library research and the development of a seminar contribution about discrete mathematics and computer science. Such project should be initiated as early as possible during the course in consultation with the professor. The project is selected by the student from an area of his/her interest and should reflect the principles of discrete mathematics and their applications as studied during this course.

COURSE EVALUATION:

Homework and Class Participation 20%
Midterm Exam 25%
Final Exam 30%
Project 25%

Letter grades will be given based on a statistical evaluation of the overall number grades.
TENTATIVE CLASS SCHEDULE:

NOTE: Numbers in parentheses refer to the chapters in Hein, James L.; Discrete Structures, Logic, and Computability, Hein, James L.; Jones & Bartlett, 2010. The scheduled material may be subject to change

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Aug</td>
<td>Elementary Notions and Notations (JLH: 1)</td>
</tr>
<tr>
<td>31 Aug</td>
<td>Facts about Functions (JLH: 2)</td>
</tr>
<tr>
<td>07 Sep</td>
<td>Construction Techniques (JLH: 3)</td>
</tr>
<tr>
<td>14 Sep</td>
<td>Equivalence, Order, and Inductive Proof (JLH: 4)</td>
</tr>
<tr>
<td>21 Sep</td>
<td>Analysis Techniques (JLH: 5)</td>
</tr>
<tr>
<td>28 Sep</td>
<td>Elementary Logic &amp; Predicate Logic (JLH: 6-7)</td>
</tr>
<tr>
<td>05 Oct</td>
<td>Methinks, I know it all: Midterm Exam</td>
</tr>
<tr>
<td>12 Oct</td>
<td>Applied Logic &amp; Computational Logic (JLH: 8-9)</td>
</tr>
<tr>
<td>19 Oct</td>
<td>Algebraic Structures and Techniques (JLH: 10)</td>
</tr>
<tr>
<td>26 Oct</td>
<td>Regular Languages and Finite Automata (JLH: 11)</td>
</tr>
<tr>
<td>02 Nov</td>
<td>Context-Free Languages and Pushdown Automata (JLH: 12)</td>
</tr>
<tr>
<td>09 Nov</td>
<td>Turing Machines and Equivalent Models (JLH: 13)</td>
</tr>
<tr>
<td>16 Nov</td>
<td>Computational Notions (JLH: 14). Presentation of Project I</td>
</tr>
<tr>
<td>23 Nov</td>
<td>Presentation of Projects II</td>
</tr>
<tr>
<td>30 Nov</td>
<td>The Day of Reckoning: Final Exam</td>
</tr>
<tr>
<td></td>
<td>Due Date of Finalized Project</td>
</tr>
</tbody>
</table>

Note: This Syllabus may be downloaded in pdf-form from our website: [http://www3.govst.edu/w-rudloff/wkr.htm](http://www3.govst.edu/w-rudloff/wkr.htm)

GSU is committed to providing all students equal access to all university programs and facilities. Students who have a documented physical, psychological, or learning disability and need academic accommodations, must register with Access Services for Students with Disabilities (ASSD). Please contact the Coordinator of ASSD in Room B1201 in person; by e-mail, assd@govst.edu; or by calling 708.235.3968. If you are already registered, please contact your instructor privately regarding your academic accommodations.