



**King Fahd University of Petroleum & Minerals**  
College of Computer Sciences and Engineering

Information and Computer Science Department

## **ICS 253: Discrete Structures I (3-0-3)**

Syllabus – Spring Term 2015 (2014-02)

---

**Designation:** Core course

**Course Website:** Blackboard CE 9

**Instructor:** Dr. Nasir Al-Darwish      **e-mail:** [darwish@kfupm.edu.sa](mailto:darwish@kfupm.edu.sa)

**Instructor Website:** <http://faculty.kfupm.edu.sa/ICS/darwish/ICS253-Spring2015>

**Class Time, Venue:**

Sec.	Time	Venue	Office Hours
02	MW 12:45 -2:00 pm	24-130	MW 2:10 - 3:15 pm

### **Catalogue Description**

Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs; Sets, Set Operations, Functions, Sequences and Summations; Mathematical Induction, Strong Induction, Recursive Definitions and Structural Induction; The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations; Discrete Probability, Probability Theory; Recurrence Relations, Solving Linear Recurrence Relations, Generating Functions, Inclusion-Exclusion; Graphs and graph Models, Graph Terminology and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Planar Graphs, Graph Coloring; Introduction to Trees, Applications of Trees, Spanning Trees.

**Note:** Most of the graph topics are now part of ICS 254.

**Prerequisite:** ICS 102: Introduction to Programming I

**Course Objectives:**

1. To develop mathematical and thinking skills necessary for reading, comprehending, and constructing mathematical arguments.
2. To learn the fundamental concepts and techniques of discrete mathematics needed for problem solving in computer science.

## Course Learning Outcomes:

After completion of this course, the student shall be able to:

1. Formulate and derive propositional/predicate logic expressions. [Program Outcome j]
2. Apply proving methods. [Program Outcome j]
3. Apply counting techniques to solve combinatorial problems. [Program Outcome j]

## Required Material

1. **Textbook:** Kenneth Rosen, Discrete Mathematics and Its Applications, 7<sup>th</sup> Ed., McGraw-Hill, 2007.  
*Publisher URL:* <http://www.mhhe.com/rosen>
2. **Lecture Slides** (provided by the instructor)

## Recommended References

1. Susanna S. Epp. Discrete Mathematics with Applications. 4<sup>th</sup> Ed., Brooks/Cole, 2010.
2. Crisler, N., Fisher, P. and Froelich, Discrete Mathematics through Applications, 2<sup>nd</sup> Ed., W. H. Freeman Co., 2000.
3. R. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, 4<sup>th</sup> Ed., Addison Wesley, 1998.

## Assessment Plan

Assignments and Quizzes	20%
Major Exam # 1	25%
Major Exam # 2	25%
Semi-Comprehensive Final Exam	30%

## Schedule of Topics

Topics		Readings*
Part1: (9 lectures)	Propositional Logic, Predicate Logic, Sets, Functions.	Ch. 1: 1-5 Ch. 2: 1-3**
Part2: (8 lectures)	Proof methods: direct proof, indirect proof, proof by contradiction, weak induction, strong induction.	Ch. 1: 6-8 Ch. 5: 1-2
Part3: (10 lectures)	Basic Counting Techniques. Sum and Product Rules. Inclusion-Exclusion. Pigeonhole Principle. Permutations. Combinations. Combination with repetition. Combinatorial Identities and Combinatorial Proofs. Binomial Theorem.	Ch. 6
Part4: (5 lectures)	Probability Axioms. Bernoulli Trials. Conditional Probability. Random Variables. Expected Value. Variance. Linearity of Expectations.	Ch. 7: skip 7.3
Part5: (10 lectures)	Advanced Counting Techniques. Generalized Inclusion-Exclusion. Formulating and Solving Recurrence Relations. Generating Functions.	Ch. 8: skip 8.3

\* based on 7<sup>th</sup> edition

\*\* Sets and functions are deemed elementary topics; no class lectures are allocated for them

## Course Policies

- **Class participation:** *Student collaboration* and class participation is encouraged; According to several studies, the more the student engagement in the learning process, the better they learn.
- **Academic honesty:** Students are expected to abide by all the university regulations on academic honesty. Cheating will be reported to the Department Chairman and will be severely penalized. Although collaboration and sharing knowledge is highly encouraged, copying others' work without proper citation, either in part or full, is considered plagiarism. Whenever in doubt, review the university guidelines or consult the instructor. Cheating in whatever form will result in F grade.
- **Attendance**
  - Attendance will be checked at the beginning of each class.
  - Each 2 late attendances will be considered as one absence.
  - 1% will be deducted for every unexcused absence.
  - More than 7 absences will result in a DN grade.
- No make-up of Assignments, Quizzes, or Exams.
- Students are responsible for all announcements made by the instructor
- Taking notes during the class is highly recommended