Discrete Mathematics with Applications, 3rd Edition
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Review Guide for Chapter 1

Compound Statements

- What is a statement? *(p. 2)*
- If p and q are statements, how do you symbolize "p but q" and "neither p nor q"? *(p. 3)*
- What does the notation $a \leq x < b$ mean? *(p. 4)*
- What is the conjunction of statements p and q? *(p. 5)*
- What is the disjunction of statements p and q? *(p. 6)*
- What are the truth table definitions for $\sim p$, $p \wedge q$, $p \vee q$, $p \rightarrow q$, and $p \leftrightarrow q$? *(pp. 5, 6, 18, 24)*
- How do you construct a truth table for a general compound statement? *(p. 7)*
- What is exclusive or? *(p. 7)*
- What is a tautology, and what is a contradiction? *(p. 13)*
- What is a conditional statement? *(p. 18)*
- Given a conditional statement, what is its hypothesis (antecedent)? conclusion (consequent)? *(p. 18)*
- What is a biconditional statement? *(p. 24)*
- What is the order of operations for the logical operators? *(p. 24)*

Logical Equivalence

- What does it mean for two statement forms to be logically equivalent? *(p. 8)*
- How do you test to see whether two statement forms are logically equivalent? *(p. 9)*
- How do you annotate a truth table to explain how it shows that two statement forms are or are not logically equivalent? *(p. 9)*
- What is the double negative property? *(p. 9)*
- What are De Morgan's laws? *(p. 10)*
- How is Theorem 1.1.1 used to show that two statement forms are logically equivalent? *(p. 14)*
- What are negations for the following forms of statements? *(pp. 10, 11, 20)*
  - $p \wedge q$
  - $p \vee q$
  - $p \rightarrow q$ (if p then q)

Converse, Inverse, Contrapositive

- What is the contrapositive of a statement of the form "If p then q"? *(p. 21)*
- What are the converse and inverse of a statement of the form "If p then q"? *(p. 22)*
- Can you express converses, inverses, and contrapositives of conditional statements in ordinary English? *(p. 21-22)*
- If a conditional statement is true, can its converse also be true? *(p. 22)*
- Given a conditional statement and its contrapositive, converse, and inverse, which of these are logically equivalent and which are not? *(p. 23)*

Necessary and Sufficient Conditions, Only If

- What does it mean to say that something is true only if something else is true? *(p. 23)*

- How are statements about only-if statements translated into if-then form.? *(p. 23)*
- What does it mean to say that something is a necessary condition for something else? *(p. 25)*
- What does it mean to say that something is a sufficient condition for something else? *(p. 25)*
- How are statements about necessary and sufficient conditions translated into if-then form.? *(pp. 25-26)*

Validity and Invalidity

- How do you identify the logical form of an argument? *(p. 2)*
- What does it mean for a form of argument to be valid? *(p. 29)*
- How do you test to see whether a given form of argument is valid? *(p. 30)*
- How do you annotate a truth table to explain how it shows that an argument is or is not valid? *(pp. 30-31)*
- What are modus ponens and modus tollens? *(pp. 31-32)*
- Can you give examples for and prove the validity of the following forms of argument? *(pp. 33-35)*

$$\begin{array}{lll} p & & q \\ \therefore\ p \vee q & \text{and} & \therefore\ p \vee q \end{array}$$

$$\begin{array}{lll} p \wedge q & & p \wedge q \\ \therefore\ p & \text{and} & \therefore\ q \end{array}$$

$$\begin{array}{lll} p \vee q & & p \vee q \\ \sim q & \text{and} & \sim p \\ \therefore\ p & & \therefore\ q \end{array}$$

$$\begin{array}{ll} p \to q & \\ q \to r & \\ \therefore\ p \to r & \end{array}$$

$$\begin{array}{ll} p \vee q & \\ p \to r & \\ q \to r & \\ \therefore\ r & \end{array}$$

- What are converse error and inverse error? *(p. 37)*
- Can a valid argument have a false conclusion? *(p. 38)*
- Can an invalid argument have a true conclusion? *(p. 38)*
- Which of modus ponens, modus tollens, converse error, and inverse error are valid and which are invalid? *(pp. 31, 32, 37, 38)*
- What is the contradiction rule? *(p. 39)*
- How do you use valid forms of argument to solve puzzles such as those of Raymond Smullyan about knights and knaves? *(p. 40)*

Digital Logic Circuits and Boolean Expressions

- Given a digital logic circuit, how do you
  - find the output for a given set of input signals *(p. 47)*
  - construct an input/output table *(p. 47)*
  - find the corresponding Boolean expression? *(p. 48)*
- What is a recognizer? *(p. 49)*
- Given a Boolean expression, how do you draw the corresponding digital logic circuit? *(p. 49)*
- Given an input/output table, how do you draw the corresponding digital logic circuit? *(p. 51)*
- What is disjunctive normal form? *(p. 52)*
- What does it mean for two circuits to be equivalent? *(p. 53)*
- What are NAND and NOR gates? *(p. 54)*
- What are Sheffer strokes and Peirce arrows? *(p. 54)*

Binary and Hexadecimal Notation

- How do you transform positive integers from decimal to binary notation and the reverse? *(p. 59)*
- How do you add and subtract integers using binary notation? *(p. 60)*
- What is a half-adder? *(p. 61)*
- What is a full-adder? *(p. 62)*
- What is the 8-bit two's complement of an integer in binary notation? *(p. 63)*
- How do you find the 8-bit two's complement of a positive integer a that is at most 255? *(p. 64)*
- How do you find the decimal representation of the integer with a given 8-bit two's complement? *(p. 65)*
- How are negative integers represented using two's complements? *(p. 66)*
- How is computer addition with negative integers performed? *(pp. 66-70)*
- How do you transform positive integers from hexadecimal to decimal notation? *(p. 71)*
- How do you transform positive integers from binary to hexadecimal notation and the reverse? *(p. 72)*
- What is octal notation? *(p. 74)*