CS 214 Introduction to Discrete Structures
Spring 2020, Section 02
Homework Exercises

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General instructions

- Homework is assigned for a section when that section's "homework slide" appears in class.
- Homework is due at the beginning of the next class lecture after it is assigned.
- It is possible that not all of the sections in this list will be covered in class; the homework for any sections not covered will not be assigned.
- Exercises with the "*x*" (for external) prefix are not in the Gersting textbook; they are from some other discrete mathematics book. They are provided on the following pages in this document.
- The exercises are subject to change. Recheck this document before starting each assignment.

Exercises and hints

Section	Exercises	Hints and problem-specific instructions
1.1	6, 22, 24, 36, *x*1	24: Remember RFGMPR #1.
1.2	12, 24, 36, 48, 50, *x*2	
1.3	6, 18, 26, 36, *x*3	
2.1	12, 20, 28, 32, 56, *x*4	28: Use contradiction. 32: Use contraposition.
2.2	8, 20, 34, 72a, 80, *x*5	80: Use second induction.
3.1	2, 22, 50, 64, 78	
3.2	4, 10, 14, 28, 46	
3.3	4, 6, 10, 16, 20, 22	16, 22: The solutions to 15 and 21 are in the book.
4.1	6, 14, 22, 28, 36, 40, 82ac, 104, *x*6	
4.2	4, 8, 14, 22, 34, 38, 42	
5.1	2, 8, 12, 24, 36, 56	
5.4	4, 8, 14, 20, 48, *x*7	
5.5	2, 4, 6, 20, 22	
6.1	2, 4, 8, 12, 16, 26, 28, 38, 47	
6.2	4, 12, 24, 48	48: Use induction on the number of leaves.
9.3	4, 8, 24, 34	

External exercises

***x*1** (Section 1.1) Consider the following two assertions about x. Assume x is a specific but unknown real number.

a. $x < 2$ or it is false that $1 < x < 3$.

b. $x \leq 1$ or either $x < 2$ or $x \geq 3$.

Define statement letters for each of the individual statements (e.g., "$x < 2$" is a statement).
If the same statement occurs more than once, use the same statement letter for all occurrences.
Using those statement letters, rewrite assertions a and b as two logical expressions.
Then construct a truth table to show that a and b are logically equivalent.

***x*2** (Section 1.2) Use propositional logic to prove that the following argument is valid.
$(A \to B) \land (B \to C) \land (B \to D) \land A \to (C \land D)$

***x*3** (Section 1.3) The domain is the diagram of Tarski's World on slide 1.81.
Define predicate $Above(x, y)$ to be true if x is above y, whether in the same or different columns.
Determine the truth value of each of the following predicate wffs.

a. $\forall u\ Circle(u) \to Gray(u)$

b. $\forall u\ Gray(u) \to Circle(u)$

c. $\exists y\ Square(y) \land Above(y, d)$

d. $\exists z\ Triangle(z) \land Above(f, z)$

***x*4** (Section 2.1) Prove the following theorem: The result of subtracting an odd integer from an even integer is an odd integer.

Hint: First rewrite the theorem in if-then form and give the variable(s) name(s).

***x*5** (Section 2.2) Use induction to prove that $2^{n+1} > n^2 + 3$ for $n \geq 2$.

***x*6** (Section 4.1) Use the methods shown in class for subset proofs to prove that $A - B \subseteq A$.

***x*7** (Section 5.4) Let P be the set of all valid computer programs written in some conventional programming language. Prove that P is denumerable. (Hint: Programs consist of ASCII characters.)

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