ICS 6D Winter 2017 **Due: Wednesday, Jan 18, 2017, 1:45PM**

Homework 1

Instructor: Sandy Irani

Covers sections 1.1-1.7, 3.1-3.6, 4.1, 4.3, 4.4, 4.6

Written Homework

zyBook Exercises are labeled in the text with an "E" in the title bar. You do not have to copy the questions for any of the written homework in your solutions that you turn in.

1) Give the truth table for the proposition $q \wedge \neg(p \vee r)$.

2) Which of the following conditional statements are true and why?

   (a) If $3 \leq 0$, then $5 \geq 4$.

   (b) If 3 is a prime number then 5 is a prime number.

   (c) If 3 is a prime number then 4 is a prime number.

   (d) If 5 is an even number, then 4 is an odd number.

3) zyBook Exercise 1.3.4

4) Use a truth table to show that the following two expressions are logically equivalent: $p \rightarrow q$ and $p \rightarrow (p \wedge q)$.

5) zyBook Exercise 1.4.3, parts b and d.

6) Translate each English sentence into a logical expression using the propositional variables defined below. Then negate the entire logical expression using parentheses and the negation operation. Apply De Morgan's law to the resulting expression and translate the final logical expression back into English. You should repeatedly apply De Morgan's law until the complement operator is applied only to individual variables.

   - w: the student has written permission from the instructor
   - a: the student has passed CS 145
   - b: the student has passed CS 151

   (a) The student has written permission from the instructor and has passed CS 145.

   (b) The student has written permission from the instructor or has passed CS 145 and CS 151.

7) zyBook Exercise 1.7.1

8) zyBook Exercise 1.7.6

9) $S = \{a, b, c\}$. Indicate whether each statement is true or false:

   (a) $\emptyset \in P(S)$.

(b) $\emptyset \subseteq P(S)$.

(c) $\{a\} \in S$.

(d) $\{a\} \in P(S)$.

(e) $a \in S$.

(f) $a \in P(S)$.

(g) $\{a\} \subseteq S$.

(h) $\{a\} \subseteq P(S)$.

(i) $a \subseteq S$.

(j) $a \subseteq P(S)$.

10) Let $X = \{1, 2, 3, 4, 5\}$. Write out the following set in roster notation: $\{A : A \in P(X) \text{ and } |A| = 3\}$.

11) zyBook Exercise 3.6.1

12) Express the following sets using the roster method. (Express elements as strings, not n-tuples.)

(a) $\{1x1 : x \in \{0, 1\}^2\}$

(b) $\{0, 1\}^2 \cup \{0, 1\}$

(c) $\{xy : x \in \{1\} \cup \{1\}^2 \text{ and } y \in \{a, b\}^2\}$

13) zyBook Exercise 4.3.4, Parts a, b, c, d, and g.

14) zyBook Exercise 4.4.2, Parts e, f, g, h.

15) zyBook Exercise 4.6.1

Challenge Activities (marked with a ”C” in the title bar)

1) Challenge Activity 3.4.1

2) Challenge Activity 3.4.2

3) Challenge Activity 3.4.3

4) Challenge Activity 4.3.1