

University of New Brunswick
Faculty of Computer Science
CS1303: Discrete Structures
Homework Assignment 1, Due Time, Date 11:59 PM, February 2, 2021

Student Name: _____ Matriculation Number: _____

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The marking scheme is shown in the left margin and [100] constitutes full marks.

[10] 1. Fill in the blanks to rewrite the given statements below.

(a) For every object J , if J is a square then J has four sides.

- i. All squares _____.
- ii. Every square _____.
- iii. If an object is a square, then it _____.
- iv. If J _____, then J _____.
- v. For every square J , _____.

(b) Every positive number has a positive square root.

- i. All positive numbers _____.
 - ii. For every positive number e , there is _____ for e .
 - iii. For every positive number e , there is a positive number r such that _____.
- (c) There is a real number whose product with every number leaves the number unchanged.
- i. There is a real number r such that the product of r _____.
 - ii. There is a real number r with the property that for every real number s , _____.

[20] 2. Let $A = \{w, x, y, z\}$, and $B = \{a, b\}$. Use the set roster notation to write each of the following sets, and indicate the number of elements that are in each set.

- (a) $A \times B$.
- (b) $B \times A$.
- (c) $A \times A$.
- (d) $B \times B$.

[10] 3. Let $S = \{0, 1\}$. List all the strings of length 4 over S that contain three or more 0's.

[20] 4. Let p , q , and r be the propositions

p : You have the flu.

q : You miss the final examination.

r : You pass the course.

Express each of these propositions as an English sentence.

- (a) $p \rightarrow q$.
- (b) $q \rightarrow \neg r$.
- (c) $p \vee q \vee r$.
- (d) $(p \rightarrow \neg r) \vee (q \rightarrow \neg r)$.
- (e) $(p \wedge q) \vee (\neg q \wedge r)$.

[20] 5. Construct a truth table for each of these compound propositions.

- (a) $p \wedge \neg p$.
- (b) $p \vee \neg p$.
- (c) $(p \vee \neg q) \rightarrow r$.
- (d) $(p \vee q) \rightarrow (p \wedge q)$.
- (e) $(p \rightarrow q) \rightarrow (q \rightarrow p)$.

[20] 6. Use the Laws of Equivalence to prove the following logical equivalences. State clearly which law(s) you are using in each step.

- (a) $\neg(p \vee (\neg p \wedge q)) \equiv \neg p \wedge \neg q$.
- (b) $(p \wedge q) \rightarrow (p \vee q) \equiv \mathbf{t}$.
- (c) $p \rightarrow (q \vee r) \equiv (p \wedge \neg q) \rightarrow r$.
- (d) $p \rightarrow (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$.