

CSE 311: Midterm Review Problems, May 1, 2014

1. Explain without using truth tables why the following compound proposition is true only when p, q, r have the same values:

$$(p \vee \neg q) \wedge (q \vee \neg r) \wedge (r \vee \neg p)$$

2. Are the following two equivalent?

$$(p \wedge q) \rightarrow r$$
$$(p \rightarrow r) \wedge (q \rightarrow r)$$

3. Section 1.5 [6th ed.: Section 1.4], Problem 25

4. Section 1.5 [6th ed.: Section 1.4], Problem 40

5. Prove the following:

$$\wp(A) \subseteq \wp(B) \leftrightarrow A \subseteq B$$

6. Both editions, Section 2.2, Problem 25

7. For all functions and mappings below, state whether they are injective, surjective or both (bijective):

- (a) $f : A \rightarrow B$, $f(x) = \frac{1}{x}$
(b) $f : B \rightarrow C$, $f(x) = x^2$
(c) $f : B \rightarrow B$, $f(x) = x^2$
(d) $f : C \rightarrow B$, $f(x) = x^2$

where:

- (a) $A = \{x | x \in \mathfrak{R}, x \geq 1\}$
(b) $B = \{x | x \in \mathfrak{R}, 0 \leq x \leq 1\}$
(c) $C = \{x | x \in \mathfrak{R}, -1 \leq x \leq 1\}$

8. Which of the following integers is congruent to 3 mod 7?

- (a) 37
(b) 66
(c) -17
(d) -67

9. Section 4.1, Problem 8 [6th ed.: Section 3.4, Problem 8]

10. (Section 4.1, Problem 33, 7th edition): Find each of the following values without a calculator by keeping the numbers in your calculations as small as you can:

- (a) $(99^2 \bmod 32)^3 \bmod 9$
(b) $(3^4 \bmod 17)^2 \bmod 11$
(c) $(19^3 \bmod 23)^2 \bmod 31$
(d) $(89^3 \bmod 79)^4 \bmod 26$

11. Section 4.3, Problem 5 [6th ed.: Section 3.5, Problem 5]

12. Section 4.3, Problem 14 [6th ed.: Section 3.5, Problem 10]

13. Section 4.3, Problem 32 [6th ed.: Section 3.7, Problem 24]

14. Using $p = 23$ and $q = 47$ encrypt the message “NO” using the RSA cryptosystem