

**BRONX COMMUNITY COLLEGE**  
of The City University of New York

DEPARTMENT OF MATHEMATICS and COMPUTER SCIENCE

CSI 30

**Final Exam Review. Set 1.**

**Present all your work in order to get full credit.**  
**Show solutions, do not give just answers.**

**Logic and Proofs**

1. Construct a truth table for the compound proposition  $(\neg p \rightarrow \neg q) \wedge (q \leftrightarrow r)$
2. Are the statements consistent?  
'If Mary takes the job offer then she will get a signing bonus.' 'If Mary takes the job offer, then she will receive a higher salary.' 'If Mary gets the signing bonus, then she will not receive a higher salary.' 'Mary takes the job offer'.
3. Show that the compound proposition  $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$  is a tautology without using truth tables.

**Sets**

4. For the sets  $A = \{a, g, f, d, t\}$ ,  $B = \{f, a, t, g\}$ ,  $C = \{f, g, t\}$ . Determine whether these statements are true or not:
  - (a)  $B \subseteq A$
  - (b)  $C \subseteq A$
  - (c)  $C \subseteq B$
5. Determine which statements are false or true
  - (a)  $\{0\} \subseteq \{0\}$
  - (b)  $\{0\} \in \{0\}$
  - (c)  $\{1, 2\} \subseteq \{1, \{1, 2\}, \{2\}, \{\{1\}, 2\}, 2\}$
  - (d)  $\{1\} \in \{1, \{1, 2\}, \{2\}, \{\{1\}, 2\}, 2\}$
6. Determine the cardinality of the set  $A = \{x \in Z^+ | x \text{ is less than } 13\}$
7. Find the powerset of  $\{a, b, c\}$
8. For the sets  $A = \{1, 2, 8\}$ ,  $B = \{a, b, 8\}$ ,  $C = \{o, m, 1\}$ . Find
  - (a) Cartesian Product  $A \times B \times C$
  - (b) Cartesian Product  $B \times C$
  - (c) Cartesian Product  $C \times B$
  - (d)  $A \cap B$
  - (e)  $B \cap C$

(f)  $A \cup B \cup C$

(g)  $A - C$

**Functions**

9. Determine whether the given functions are bijective. Are they invertible? If a function is invertible, what is its inverse?

(a)  $f : \{1, 2, 3, 4, 5\} \rightarrow \{a, b, c, d\}$  with  $f(1) = a, f(2) = b, f(3) = a, f(4) = c, f(5) = d$

(b)  $f : \mathbb{R} \rightarrow \mathbb{R}, f(x) = -5x^2 + 8$

10. Let  $f(x) = \frac{x-5}{x+3}$ . Find  $f(S)$  if  $S = \{-1, 0, 2, 3\}$

**Algorithms**

11. Write a pseudocode for finding the smallest and the largest value in the list of integers.

**Integers**

12. Evaluate these quantities:

(a)  $-21 \bmod 6$

(b)  $23 \bmod 11$

13. Decide whether each of these integers is congruent to 3 modulo 13

(a)  $-24$

(b)  $42$

14. Find the prime factorization for each of these integers:

(a) 899

(b) 31

(c) 189

15. Find the greatest common divisors using Euclidean algorithm.

(a) 132, 89

(b) 78, 64

(c) 42, 221

**Counting**

16. A particular brand of pants come in 7 colors, has a male version and a female version, and comes in four sizes for each sex. How many different types of this pants are made?

17. How many bit-strings of length 7 are there, that start with 1 or end with 1?

18. List all 3-permutations and 3-combinations of the set  $S = \{a, b, c, d\}$ .

19. Find the values of  $P(14, 9)$  and  $C(34, 5)$ .

20. How many bit-strings of length 11 contain

(a) three 1's in the beginning?

(b) at least seven 1's?

(c) number of 1's in one less than the number of 0's?