SOLUTIONS

BRONX COMMUNITY COLLEGE
of the City University of New York

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

CSI 30 — Exam 1
Kerry Ojakian — FALL 2025
YOUR NAME (first, then last):

Directions: Write your responses in the provided space. To get full credit you **must** show all your work. Simplify your answers whenever possible. Be certain to indicate your final answer clearly. **No** electronic devices are allowed (i.e. no calculators, no phones, no smart watches, etc) - using one during the exam will result in at least a failure on this test. Each question is worth 10 points.

1. Construct a truth table for the following proposition and state whether it is a tautology, contradiction, or contingency: $(X \wedge \neg Y) \rightarrow (\neg Y)$

X	Y	$\neg Y$	$X \wedge \neg Y$	$(X \wedge \neg Y) \rightarrow \neg Y$
F	F	T	F	T
F	T	F	F	T
T	F	T	T	T
T	T	F	F	T

Last col all True so Tautology

2. Are these system specifications consistent?

   - Laughing is forbidden.
   - Crying is not allowed.
   - If laughing is forbidden, then crying is allowed.

L = "Laughing forbidden"
C = "Cryin allowed"
[OR DO TRUTH TABLE]

Statements, so to be true
- L ⇐ L = True
- $\neg C$ ⇐ C = False
- $L \rightarrow C$ ⇐ then False.

⇒ Not Consistant

3. Show that the following 2 propositions are logically equivalent: $\neg X$ and $\neg\neg\neg X$

X	$\neg X$	$\neg\neg X$	$\neg\neg\neg X$
F	T	F	T
T	F	T	F

columns under $\neg X$, $\neg\neg\neg X$ same $\Rightarrow$ equivalent

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4. Let $P(x, y)$ denote the statement: "$x < y$ and $x^2 < 10$". What are the truth values of the following?

(a) $P(4, 6)$ False since $4^2 < 10$ False

(b) $P(5, 4)$ False since $5 < 4$ False

(c) $P(3, 3)$ False since $3 < 3$ False

(d) $P(-2, 9)$ True since $-2 < 9$ true and $(-2)^2 < 10$

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5. Suppose the domain is all integers. For each statement, is it true or false?

(a) $\forall x\ x^2 \geq 0$

(b) $\exists y\ y^3 = -8$

(c) $\exists x \forall y\ y > x$

(d) $\forall x \exists y\ y = x + 3$

a) True. Square negative is positive

b) True. $y = -2$

c) False. No smallest integer

d) True. Choose y to be x value plus 3

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6. List the members of these sets.

(a) $\{x \mid x$ is a postive integer less than $6\}$

1, 2, 3, 4, 5

(b) $\{y \mid y$ is an integer such that $y = -y\}$

$\emptyset$

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7. Suppose $A = \{3, 4, 5, 9, 15\}$ and $B = \{1, 2, 5, 9, 11\}$. Find the following (just give the answer).

(a) $A \cup B$

(b) $A \cap B$

(c) $A - B$

(d) $B - A$

a) $\{1, 2, 3, 4, 5, 9, 11, 15\}$

b) $\{5, 9\}$

c) $\{3, 4, 15\}$

d) $\{1, 2, 11\}$

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8. Suppose the universal set is $U = \{0, 2, 4, 6, 8, 10, 12\}$. Suppose $A = \{2, 4, 8\}$ and $B = \{0, 4, 8, 12\}$. Find the following.

(a) $\overline{B}$ (b) $\overline{A} \cup B$

a) $\{2, 6, 10\}$

b) $\{0, 6, 10, 12\} \cup \{0, 4, 8, 12\}$
$= \{0, 4, 6, 8, 10, 12\}$

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9. Prove that $(A \cap B) \cup B \subseteq B$ (do it from definitions or using a membership table).

A	B	$A \cap B$	$(A \cap B) \cup B$
0	0	0	0
0	1	0	1
1	0	0	0
1	1	1	1

True since when column B has 1, so does last column

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10. Prove that if $A|B$ and $B|C$, then $A|C$.

① There is integer k such that $B = kA$ since $A|B$
② There is integer m such that $C = mB$ since $B|C$
③ $C = mB = mkA$ using ① and ②
④ Thus $A|C$, since $C = (mk)A$ where mk is integer.
