

Determine if the following argument is valid. State your final answer clearly.

SCORE: ____ / 8 PTS

NOTES: This is NOT an essay question. Use the method shown in lecture and section 2.3. Do NOT use the Rules of Inference.

If I save a lot of money, then I can quit my second job or I can buy a new car.
 I did not save a lot of money and I cannot quit my second job.
 Therefore, I cannot buy a new car.

(-1/2) FOR EACH ERROR IN TRUTH TABLE (MINIMUM 10) SCORE

$p \rightarrow (q \vee r)$
 $\sim p \wedge \sim q$
 $\therefore \sim r$

(1) FOR IDENTIFYING WHICH WERE CRITICAL ROWS (LAST 2)

p	q	r	q ∨ r
T	T	T	T
T	T	F	T
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	T
F	F	T	T
F	F	F	F

$p \rightarrow (q \vee r)$	$\sim p$	$\sim q$	$\sim p \wedge \sim q$	$\sim r$
T	F	F	F	F
T	F	F	F	F
T	F	T	F	F
F	F	T	F	F
T	T	F	F	F
T	T	F	F	F
T	T	T	F	F
T	T	T	F	F

(1) INVALID

(F) } CRITICAL ROWS
 (T) }

Consider the statement "if $\frac{1}{x} < 1$, then $x > 1$ ". (Assume x is a particular real number.)

SCORE: ___ / 4 POINTS

[a] Write a logically equivalent statement using "is necessary for". Do NOT use statement variables in your final answer.

① $x > 1$ IS NECESSARY FOR $\frac{1}{x} < 1$

m IS NECESSARY FOR n
 $n \rightarrow m$

[b] Write a logically equivalent statement using "unless". Do NOT use statement variables in your final answer.

① $x > 1$ UNLESS $\frac{1}{x} \neq 1$

m UNLESS n
 $\sim n \rightarrow m$

[c] Write the contrapositive of the statement. Do NOT use statement variables in your final answer.

① IF $x \neq 1$ THEN $\frac{1}{x} < 1$

OK IF YOU SAID " $\frac{1}{x} \geq 1$ " INSTEAD OF " $\frac{1}{x} < 1$ "
 AND " $x \leq 1$ "

[d] Write the negation of the statement. Do NOT use statement variables in your final answer.

① $\frac{1}{x} < 1$ AND $x \neq 1$

INSTEAD OF " $x \neq 1$ "
 $\sim(p \rightarrow q) \equiv \sim(\sim p \vee q)$
 $\equiv p \wedge \sim q$

Classify each statement as Universal Existential (UE), Existential Universal (EU) or Universal Conditional (UC). **SCORE: ___ / 2 POINTS**

[a] All calculus students have passed the same placement test. EU ①

[b] Students who have parking stickers can park in lot C. UC ①

Write the formal definition of a relation used in discrete math. Use correct English and mathematical notation. SCORE: _____ / 2 PTS

A RELATION FROM SET A TO SET B IS A SUBSET OF $A \times B$
GRADED BY ME

Determine if $p \oplus q \equiv \sim p \leftrightarrow q$. State your final answer clearly.

SCORE: ____ / 3 PTS

p	q
T	T
T	F
F	T
F	F

①
p ⊕ q

F
T
T
F

①
~p

F
F
T
T

①
~p ↔ q

F
T
T
F

①
YES, $p \oplus q \equiv \sim p \leftrightarrow q$

①
FOR EACH ERROR IN TRUTH TABLE (MINIMUM

SCORE = 0)

Fill in the blanks for the following formal definitions. Use proper mathematical notation.

SCORE: _____ / 4 PTS

②

[a] Given sets M and N , N is a subset of M (or $N \subseteq M$) if and only if FOR ALL $x \in N$, $x \in M$

[b] The Cartesian product of sets M and N is $M \times N =$ $\{(x, y) \mid x \in M \text{ AND } y \in N\}$ ②

If $N = \{0, 1, 2, 3, 4, 5, 6, 7, 8\}$ and $L = \{a, b, c, d, e, f, g, h, i, j, k\}$,
how many elements are in the Cartesian product of L and N ?

SCORE: _____ / 2 PTS

$$\underbrace{9 \times 11}_{(1)} = \underbrace{99}_{(1)}$$

Rewrite the following statement using 2 variables and the formal structure mentioned in the 1.1 lecture notes.

SCORE: ____ / 2 PTS

NOTE: Do NOT use any symbols, except for the variables.

“There’s an instructor for each class.”

THE ORDER IS IMPORTANT
FOR THIS PART (“FOR EACH” BEFORE
“THERE IS”)

FOR EACH CLASS C , THERE IS A PERSON P ①

SUCH THAT P IS THE INSTRUCTOR FOR C , ①

Consider the following statements.

SCORE: _____ / 2 PTS

(i) $\{x\} \subseteq \{x, y, \{z\}\}$

(ii) $\{z\} \in \{x, y, \{z\}\}$

(iii) $\{z\} \subseteq \{x, y, \{z\}\}$

Which of the statements above are true? Circle the correct answer below.

[a] none are true

[b] only (i) is true

[c] only (ii) is true

[d] only (iii) is true

[e] only (i) and (ii) are true

[f] only (i) and (iii) are true

[g] only (ii) and (iii) are true

[h] all are true

2