

LAST Name _____ FIRST Name _____

Lab Time _____

- **(5 Points)** Print your name and lab time in legible, block lettering above.
- This quiz should take up to 20 minutes to complete. You will be given at least 20 minutes—up to the end of today’s lecture hour—to work on the quiz.
- **This quiz is closed book.** Collaboration is not permitted. You may not use or access, or cause to be used or accessed, any reference in print or electronic form at any time during the quiz. Computing, communication, and other electronic devices (except dedicated timekeepers) must be turned off. Noncompliance with these or other instructions from the teaching staff—including, for example, commencing work prematurely or continuing beyond the announced stop time—is a serious violation of the Code of Student Conduct.
- **The quiz printout consists of pages numbered 1 through 4.** When you are prompted by the teaching staff to begin work, verify that your copy of the quiz is free of printing anomalies and contains all of the four numbered pages. If you find a defect in your copy, notify the staff immediately.
- Please write neatly and legibly, because *if we can’t read it, we can’t grade it.*
- For each problem, limit your work to the space provided specifically for that problem. *No other work will be considered in grading your quiz. No exceptions.*
- Unless explicitly waived by the specific wording of a problem, you must explain your responses (and reasoning) succinctly, but clearly and convincingly.
- We hope you do a *fantastic* job on this quiz.

Problem	Points	Your Score
Name	5	
1	16	
2	14	
3	10	
Total	45	

Q1.1 (16 Points) Consider the following sets:

$$A = \{a\}, \quad B = \{a, b\} \quad C = \{a, b, c\} \quad T = \{1, 2\}.$$

(a) Let $[B \rightarrow T]$ denote the set of all functions from B to T .

(i) List all the elements of $[B \rightarrow T]$.

(ii) How many elements are in $P([B \rightarrow T])$, the power set of $[B \rightarrow T]$?
Specify one element of $P([B \rightarrow T])$ other than the empty set ϕ .

(b) Determine the truth or falsehood of each of the following assertions.

If you find an assertion to be false, provide a counterexample by finding an element in the purported subset which is not a member of the purported superset. If you find an assertion to be true, prove that every element in the purported subset is a member of the purported superset.

(i) $[A \rightarrow C] \subset [B \rightarrow C]$.

(ii) $[A \rightarrow B] \subset [A \rightarrow C]$.

Q1.2 (14 points) (a) A function $H : \mathbb{R} \rightarrow \mathbb{C}$ is characterized as follows:

$$H(\omega) = \begin{cases} +i & \omega \leq 0 \\ -i & \omega > 0. \end{cases}$$

Determine and sketch the magnitude $|H(\omega)|$ and phase $\angle H(\omega)$ of the function H .

(b) Numerically evaluate $\sin(i \ln i)$, where $\ln : \mathbb{C} - \{0\} \rightarrow \mathbb{C}$ denotes the natural logarithm function.

Q1.3 (10 points) Let the function $f : \mathbb{N}_0 \rightarrow V$ be defined as follows:

$$\forall n \in \mathbb{N}_0, \quad f(n) = 2n,$$

where $\mathbb{N}_0 = \{0, 1, 2, 3, \dots\}$ is the set of nonnegative integers, and V is a subset of the real numbers \mathbb{R} .

(a) Is the function f one-to-one? Explain your reasoning succinctly, but clearly and convincingly.

(b) If you are told that f is onto, determine the set V .

You may use the blank space below for scratch work. Nothing written beyond this line will be considered in grading.
