

A1:	___ ___	45pts
A2:	___ ___	45pts
A3:	___ ___	50pts
A4:	___ ___	50pts
A5:	___ ___	70pts
Bonus:	___ ___	10pts

Note. This is an open brain, open (pristine) Sigmon-Notes exam. Please write each solution on a separate sheet of paper. Write expressions unambiguously e.g, “ $1/a+b$ ” should be bracketed either $[1/a] + b$ or $1/[a + b]$. (Be careful with **negative** signs!) Every “**if**” must be matched by a “**then**.”

A1: Please prove Thm1.4d: (P.2)
If $e \in \mathbb{R}$ is an *multiplicative-identity* then $e = 1$.

A2: 1.18c: (P.6) Harmonic-Mean Inequality.

A3: Prove the triangle ineq., Thm1.20g:(P.6)
When $x, y \in \mathbb{R}$ then $|x| + |y| \geq |x + y|$.

A4: Let “ $*$ ” mean “*theorems earlier than* (1.15f)”.
Using $(*)$ prove: Lemma: *If $z \neq 0$ then z^2 is positive.*
Now use this and $(*)$ to prove that $-1 < 0$.

A5: For each of the following statements in quotes, circle one of **T F**. *Then* provide a **proof** or a **CEX with explicit numbers**.

a “Addition distributes over mult.” **T F**

b “Subtraction is associative.” **T F**

c On \mathbb{R} define $x \triangleleft y := [x \cdot y] + y$. Then
“binop \triangleleft is associative”. **T F**

d On the set of all people, give an example of a binrel which is *transitive* and *reflexive*, but is not *symmetric*.

Bonus: Define a binop “ \times ” by

$$b \times c := 7 - \left[[7 + b] \triangleleft [7 + c] \right]$$

Prove or give a CEX: “Binop \times is associative.”

End of Exam-A

Total: ___ ___ ___ 260pts

Print name _____ Ord: _____

HONOR CODE: “*I have neither requested nor received help on this exam other than from my professor.*”

Signature: _____

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