Always justify your answers, even if the question does not explicitly say so. Write your own solutions, independently of anyone else.

Core Problems: When a problems says “Find all ring homomorphisms . . .”, I want a list with no repeats (and of course, none missing).

I. Sec. 4.1 # 12. (Use bars correctly, and explain why your solutions are distinct.)

II. Sec. 4.1 # 14a, 16b. (Some symbols are missing in some printings of #16. See Ted Shifrin’s webpage for corrections.)

III. Sec. 4.1 # 19.

IV. Sec. 4.2 # 3 abcef (Remember, to prove $R/I \cong S$, you want to find a surjective ring homomorphism $\phi: R \to S$ with $\ker \phi = I$. Also remember that $\mathbb{Z}_{12} = \mathbb{Z}/\langle 12 \rangle$.)

V. Sec. 4.2 # 5 (Before doing (a), first prove that $R$ is a commutative subring of the (non-commutative!) ring $M_2(\mathbb{R})$.

VI. Sec. 4.2 # 11 ab (If any of the rings are isomorphic, prove it using Theorem 2.2 if you can.)

Advanced Problems: Due Wed. Dec. 2. Students registered for 6000 must turn these problems in. They count for extra credit for 4000 students, but anyone hoping to get an ‘A’ in 4000 should do a reasonable number of advanced problems. Please hand in Advanced Problems separately from Core Problems.

VII. Sec. 4.2 # 13. (In part (d), instead of using Exercise 12, use Exercise 4.1.21.)

VIII. Sec. 4.2 # 27.