

The “ungraded” problems have their answers in the back. You are encouraged to work them and solutions will be provided, but they are, well, not graded. It is not necessary to submit these in your assignment. On the other hand, they are occasionally the basis for exam questions. You are always invited to work other problems as well. It may happen that part of a question is answered in the back of the book. You will not receive full credit unless you add some explanation. The symbol ( $\mathcal{E}$ ) means that at least part of this problem appeared on an old exam, up to possible numerical alterations. The book numbers all problems in a chapter sequentially. The problems in this homework are all from Chapter Four, except for #1. **It is important to write your proofs carefully and clearly. It is important to cite results in the book if you write down an answer without doing much computation.**

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(ungraded) Strayer – Chapter 4: 1ac, 12a, 14ace

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1. Strayer – Chapter 3: 51. (For (b), you can use Theorem 3.1, but you have to show that  $f(n) = n^k$  is multiplicative.)
2. Strayer – Chapter 4: 1b, 12b
3. Strayer – Chapter 4: 14bd
4. ( $\mathcal{E}$ ) Test 1 Revisited.
  - a. Find the smallest non-negative residue for  $18^{281} \pmod{87}$ . Note:  $87 = 3 \cdot 29$ .
  - b. Find the largest integer  $n$  so that  $12^n \mid 100!$ . Note: 12 is not prime.
5. ( $\mathcal{E}$ ) Suppose  $m$  and  $n$  are relatively prime and

$$u \equiv 1 \pmod{m} \quad u \equiv 0 \pmod{n}.$$

Find (with proof)  $v$ , in terms of  $u, m, n$  so that

$$v \equiv 0 \pmod{m} \quad v \equiv 1 \pmod{n}.$$

Hint: think about  $u + v$ .

6. ( $\mathcal{E}$ ) Compute the value of the Legendre symbol  $\left(\frac{-14}{79}\right)$ . If you use the Law of Quadratic Reciprocity, do so explicitly.
7. ( $\mathcal{E}$ ) Same as above, but for  $\left(\frac{20}{67}\right)$ .