Section:

Computer Science 243 Spring 2025 Homework 7

Due: 11:59 p.m., Wednesday, 3/26/25

Answer the following questions and show your work. Your final submission must be completely your own work.

- 1. [4 points] Find *a* **div** *m* and *a* **mod** *m* for each of the following [no work need be shown]:
 - a. *a* = 105, *m* = 19
 b. *a* = −2117, *m* = 31
- 2. [9 points] For each representation given in decimal, binary, octal, or hexadecimal, convert the value of each to the other three formats [for decimal to binary, show repeated division by 2; for binary or hex to decimal, show powers of 2 or 16 that are added; for binary to octal or hex (or reverse), show grouping of bits to octal or hex digits]:
 - a. 114₁₀
 b. 1100 0011₂
 c. AD₁₆
- 3. [4 points] Determine whether the integers in the following sets are pairwise relatively prime [no work need be shown]. If not, state the integers and their common factor(s).
 - a. 19, 24, 35b. 21, 34, 59, 85
- 4. [6 points] Find the gcd's and lcm's of the following pairs of integers [express integers in prime factorization first].
 - a. 24, 32 b. 48, 64 c. $2^2 \cdot 3^3 \cdot 7, 2^3 \cdot 3^2 \cdot 5^2$
- 5. [4 points] Use the Euclidean algorithm to find gcd (105, 96). Find Bézout coefficients, *s* and *t*, to express this gcd as a linear combination of 105 and 96 [show work similar to slide 45 in Chapter 4].
- 6. [6 points] Use Fermat's Little Theorem to find the following [show work similar to slide 48 in Chapter 4]:
 - a. 3¹¹⁹ mod 5
 b. 5¹⁴³ mod 7

Name:

Points: 50

7. [4 points] Decrypt the following messages which were encrypted using the Caesar cipher with a shift of 3 [no work need be shown]:

a. ODCB GRJb. LGHV RI PDUFK

- 8. [3 points] Encrypt the word SPRING by translating the letters into numbers (0-25), applying the encryption function $f(p) = (2p + 11) \mod 26$, and then changing the numbers back to letters.
- 9. [10 points] Find the following values for various codes [show work similar to slides 54-55 and 70 in Chapter 4].
 - a. [3 points] Compute the check digit for a UPC with the first 11 digits: 84171013869.
 - b. [3 points] Compute the check digit for an ISBN10 with the first 9 digits: 164558933.
 - c. [4 points] Encrypt the word JUMP using RSA encryption with key (2537, 13).