CSE2023 - ASSIGNMENT #3

Solve the following questions from course book. (Discrete Mathematics and Discrete Mathematics and Its Applications, 7th Ed. by Kenneth Rosen)

Note that we may grade selected questions from HWs.

1. Show that if *a, b, c*, and *d* are integers, where $a \neq 0$, such that a | c and b | d, then ab | cd.

2. Find the integer *a* such that
   a. $a \equiv 40 \pmod{23}$ and $-22 \leq a \leq 0$.
   b. $a \equiv 15 \pmod{29}$ and $-14 \leq a \leq 14$.
   c. $a \equiv -20 \pmod{21}$ and $90 \leq a \leq 110$.

3. Show that if *n* is an integer then $n^2 \equiv 0$ or $1 \pmod{4}$

4. Show that if $2^m + 1$ is an odd prime, then $m = 2^n$ for some nonnegative integer n.

5. Use the Euclidean algorithm to find
   a. gcd(4, 5)
   b. gcd(200, 121)
   c. gcd(123, 271)
   d. gcd(1529, 14039)
   e. gcd(1530, 14040)

6. Show that there is a composite integer in every arithmetic progression ak + b, k = 1, 2, . . . where a and b are positive integers.

7. A parking lot has 31 visitor spaces, numbered from 0 to 30. Visitors are assigned parking spaces using the hashing function h(k) = k mod 31, where k is the number formed from the first three digits on a visitor's license plate.
   a. Which spaces are assigned by the hashing function to cars that have these first three digits on their license plates: 317, 918, 007, 100, 111, 310?
   b. Describe a procedure visitors should follow to find a free parking space, when the space they are assigned is occupied.

8. Another way to resolve collisions in hashing is to use *double hashing*. We use an initial hashing function *h(k)* = *k* **mod** *p* where *p* is prime. We also use a second

hashing function $g(k) = (k + 1) \bmod (p - 2)$.When a collision occurs, we use a *probing sequence* $h(k, i) = (h(k) + i \cdot g(k)) \bmod p$.
Use the double hashing procedure with p = 4969 to assign memory locations to files for employees with social security numbers k1 = 132489971, k2 = 509496993, k3 = 546332190, k4 = 034367980, k5 = 047900151, k6 = 329938157, k7 = 212228844, k8 = 325510778, k9 = 353354519, k10 = 053708912.

9. Suppose you received these bit strings over a communications link, where the last bit is a parity check bit. In which string are you sure there is an error?
    a. 00000111111
    b. 10001100110
    c. 10101010101
    d. 11111100000
    e. 10111101111

10. Prove that a parity check bit can detect an error in a string if and only if the string contains an odd number of errors

Submission Instruction

- Please zip and submit all your files using filename ***YourNumberHW2.zip*** (ex: 150629573HW2.zip) to Canvas system (under Assignments tab).
- Select meaningful file names for your zipped files (Ex: HW2Prob1_YourNumber.pdf or HW2_YourNumber.pdf)

Notes:

1. Write your name and student ID on each sheet.
2. No late submission will be accepted