0360-212 Winter 2017 Lab Assignment 5

Due@Bb: Mar. 13, 11:59pm

For all the questions below, if there is any ambiguity in the descriptions, make your own assumptions and document them in your code as comments.

Question 1:

Write a Java program that implements a recursive method power(base, exponent) that, when called, returns

$\text{base}^{\text{exponent}}$

For example, power(3, 4) = 3 * 3 * 3 * 3. Assume that exponent is an integer greater than or equal to 1. (Hint: The recursion step should use the relationship

$\text{base}^{\text{exponent}} = \text{base} \cdot \text{base}^{\text{exponent} - 1}$

and the terminating condition occurs when exponent is equal to 1, because

$\text{base}^1 = \text{base}$

Question 2:

Continue on Question 1, when computing

$\text{base}^{\text{exponent}}$

If exponent is even, then

$\text{base}^{\text{exponent}} = (\text{base}^{\text{exponent}/2})^2$

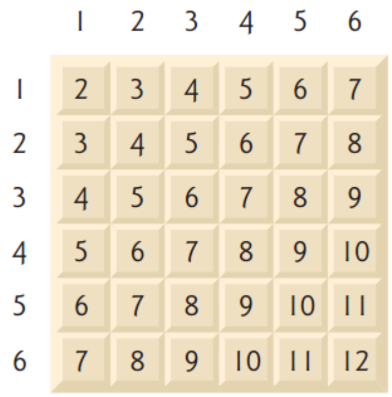
Improve your program in Question 1 by making use of the fact above.

Question 3:

The greatest common divisor of integers x and y is the largest integer that evenly divides into both x and y. Write a recursive method gcd that returns the greatest common divisor of x and y. The gcd of x and y is defined recursively as follows: If y is equal to 0, then gcd(x, y) is x; otherwise, gcd(x, y) is gcd(y, x%y), where % is the remainder operator.

Question 4:

Write an application to simulate the rolling of two dice. The application should use an object of class Random once to roll the first die and again to roll the second die. The sum of the two values should then be calculated. Each die can show an integer value from 1 to 6, so the sum of the values will vary from 2 to 12, with 7 being the most frequent sum, and 2 and 12 the least frequent. The figure below shows the 36 possible combinations of the two dice. Your application should roll the dice 36,000,000 times. Use a one-dimensional array to tally the number of times each possible sum appears. Display the results in tabular format.



	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

Question 5:

Create a class HugeInteger which uses a 40-element array of digits to store integers as large as 40 digits each. Provide methods parse, toString, add and subtract. Method parse should receive a String, extract each digit using method charAt and place the integer equivalent of each digit into the integer array. For comparing HugeInteger objects, provide the following methods: isEqualTo, isNotEqualTo, isGreaterThan, isLessThan, isGreaterThanOrEqualTo and isLessThanOrEqualTo. Each of these is a predicate method that returns true if the relationship holds between the two HugeInteger objects and returns false if the relationship does not hold. Provide a predicate method isZero.