University of Maryland Baltimore County Department of Information Systems Fall 2021

IS 709/809: Computational Methods for IS Research Homework 1

(Handed Out: September 9, 2021 (Thursday), Due: September 16, 2021 (Thursday) Midnight)

General Instructions: Please use A4 size paper for your answer sheets. Number each page and write down the total number of pages on the right-hand corner of the first page and upload to Blackboard in Homework folder by the deadline. Thanks.

- 1. (10 points) Compute the following using your calculator: $\log_2 351$ and $\log_5 93$. Limit your answers to 4 decimal places.
- 2. (10 points) Prove that $\log_C A^B = B \log_C A$.
- 3. (10 points) Prove $\sum_{j=1}^{N} (2j-1) = n^2$.
- 4. (10 points) Prove: If $n \ge 2$, then $n^3 n$ is always divisible by 3, where n is a natural number.
- 5. (10 points) Prove: There is no greatest even integer.
- 6. (10 points) Prove or disprove: $2n^2 + 5n + 10 < 1000n$, n is an integer and n > 0.
- 7. (10 points) Evaluate $\sum_{i=0}^{\infty} \frac{1}{4^i}$.
- 8. (10 points) Fill in the blanks:
 - (a) $\ldots \equiv 16 \pmod{7}$
 - (b) $35 \equiv \dots \pmod{4}$
 - (c) $123 \equiv 73 \equiv 3 \pmod{2}$
- 9. (10 points) Given an array of N = 10,000 integers, how many comparisons or checks does the binary search algorithm need to perform to determine if an arbitrary integer k is in the array or not? Give the number of comparisons as a whole number using the ceiling operator.
- 10. (10 points) Write a recursive C function that computes the greatest common divisor of two integers. The greatest common divisor (gcd) of two integers a and b is given by:

$$gcd(a,b) = \begin{cases} a & \text{if } b = 0;\\ gcd(b,a\%b) & \text{if } a \ge b \text{ and } b > 0, \end{cases}$$

where the symbol % is the modulo operator in C/C++ (that is, a%b gives the remainder when a is divided by b).

Give the sequence of recursive calls when gcd(333, 185) is invoked. What is the result of gcd(333, 185)?