

University of Maryland Baltimore County
Department of Information Systems
Fall 2017

IS 709/809: Computational Methods for IS Research

Homework 1

(Handed Out: September 12, 2017 (Tuesday), Due: September 19, 2017 (Tuesday) Before Class)

General Instructions: Please use A4 size paper for your answer sheets. Use blue or black ink only. Number each page and write down the total number of pages on the right-hand corner of the first page. 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 $n \geq 2$, 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) $\text{-----} \equiv 16 \pmod{7}$
 - (b) $35 \equiv \text{-----} \pmod{4}$
 - (c) $123 \equiv 73 \equiv 3 \pmod{\text{-----}}$
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:

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

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 $\text{gcd}(333, 185)$ is invoked. What is the result of $\text{gcd}(333, 185)$?