

MATH/EECS 1019: DISCRETE MATH FOR COMPUTER SCIENCE
FALL 2014

Assignment 3 (Released November 2 , 2014)

Submission deadline: 6:45 pm, Nov 17, 2014

Notes:

1. The assignment can be handwritten or typed. It MUST be legible.
2. You must do this assignment individually.
3. Submit this assignment only if you have read and understood the policy on academic honesty on the course web page. If you have questions or concerns, please contact the instructor.
4. Use the dropbox near the EECS main office to submit your assignments, OR submit your assignment online using the `submit` command from a EECS computer or the web interface to submit from any computer (follow instructions on the class webpage). No late submissions will be accepted. Please do not send files by email.
5. Your answers should be precise and concise. Points may be deducted for long, rambling arguments.
6. Assume \mathbb{R} to denote the real numbers, \mathbb{Z} to denote the set of integers $(\dots, -2, -1, 0, 1, 2, \dots)$ and \mathbb{N} to denote the natural numbers $(1, 2, 3, \dots)$.

Question 1

[2+2 points] Functions

1. Find $g^{-1}(3)$ given $g(x) = \frac{3x+1}{2x+g(x)}$.
2. Let f be the function $f(x) = ax^2 - \sqrt{2}$ for some positive real number a . If $f(f(\sqrt{2})) = -\sqrt{2}$ what is a ?

Question 2

[2+2 points] Logarithms

1. Let $x = 2^{\log_b 3}$ and $y = 3^{\log_b 2}$. Find $x - y$.
2. If $\frac{\log_b a}{\log_c a} = \frac{19}{99}$ and $\frac{b}{c} = c^k$, compute k .

Question 3

[4 points] Sequences and Series

The first four terms of an arithmetic sequence (in order) are $x + y$, $x - y$, xy and x/y . What is the value of the fifth term?

Question 4

[4 points] Sequences and Series

Find a formula, in terms of n , for the sum of the first n terms of the sequence

$$1, 1 + 2, 1 + 2 + 2^2, 1 + 2 + 2^2 + 2^3, \dots$$

Question 5

[4 points] Functions, Induction

Let $f : \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = \frac{x}{1-x}$. Define $f^2(x) = f(f(x))$, $f^3(x) = f(f(f(x)))$ and so on. Guess the form for $f^n(x)$ and prove your answer correct using induction on n .