MATH 4143-001/5043-001, FALL 2012, SYLLABUS

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1. Basic Course Information

Prerequisites: Math 4013 and Math 4023.

Textbooks: *Principles of Mathematical Analysis* by Walter Rudin, 3rd Edition.

Content: Chapter 1 - 6 of the text. This will be a rigorous treatment of the real and complex number systems, the metric and topological properties, sequences and series, differential calculus in one and several variables.

Class Time: MWF 10:30am - 11:20am Start on Monday August. 20, 2003.

Class Room: MSCS 422.

Office Hours: MWF 1:30pm - 2:20pm. Highly recommended to take full and consistent advantage on my office hours.

2. Exams, Homework and Grade

Your grades will be determined by the scores on one middle-term fifty-minute tests (each worth 100 pts), Homework is worth 200pts and the final exam is worth 200pts.

A as 450-500; **B** as 400-449; **C** as 350-399; **D** as 300-349; **F** as 0-299.

Middle-term Exam: October 15, 2012

FINAL EXAM: Wednesday, December 14, 10:00am - 11:50am at MSCS 422.

3. Homework

Homework assignments will be updated in D2L and due date will be announced in D2L as well.

(1) HW 1: Page 21, 1 and page 22, 2, 4, 5, 6, 8.
(2) HW 2 : Page 22, 9, 10, 11, 14, 18, 19.
(3) HW 3 : Page 43, 2, 3, 5, 6, 7, 8.

(4) HW 4 : Page 43-Page 44, 9, 10, 12, 13, 14, 15.

(5) HW 5 : Page 44-45, 17, 18, 19, 20, 22, 23, 29.

(6) HW 6 : Page 78, 3, 4, 5, 7, 8, and

- Let x be an irrational number in $(0,1)$. Define $q_1 = [\frac{1}{x}]$ be the largest integer of $\frac{1}{x}$ and $r_1 = \frac{1}{x} - q_1$. Let $r_0 = x$, one can define q_n, r_n by the following

$$\frac{1}{r_n} = q_{n+1} + r_{n+1}, \quad n \geq 0, \quad q_{n+1} = [\frac{1}{r_n}].$$

(a) Show the algorithm cannot stop at finite steps.

(b) Let x_n be the number

$$x_n = \frac{1}{q_1 + \frac{1}{q_2 + \frac{1}{\cdots + \frac{1}{q_{n-1} + \frac{1}{q_n}}}}}.$$

Show that $|x - x_n| \leq \frac{1}{q_n}$ for $n \geq 1$.

(c) If N of the q_k's are bounded by c, show that

$$|x - x_n| \leq (\frac{c+1}{c+2})^N,$$

for all but finitely many n. Note that $x \leq (q_2+1)/(q_2+2)$.

(d) Show that for the infinite many rational numbers x_n, $\lim_{n\to\infty} x_n = x$ (either $q_n \to \infty$ or q_n not go to ∞).

(7) HW 7: Page 79-81, 11, 12, 13, 17, 19, 20,

- Let $\{a_n\}$ be a sequence of real numbers which satisfies

$$a_m + a_n - 1 \leq a_{m+n} \leq a_m + a_n + 1,$$

for all n, m natural numbers. Prove that (a) $\lim_{n\to\infty} \frac{a_n}{n}$ exists if it is bounded; and (b) Show that for all n and $\alpha = \lim_{n\to\infty} \frac{a_n}{n}$, one has

$$n\alpha - 1 \leq a_n \leq n\alpha + 1.$$

(8) HW 8 : Page 98, 1, 2, 3, 5, 6, 16, 18, 20.

(9) HW 9 : page 99, 9, 11, 13, 14, 17, 22, 23.

(10) HW 10: page 114, 3, 4, 5, 6, 8, 9, 11, 13.

(11) HW 11: page 115, 14, 15, 16, 17, 19, 21, 22, 25.

(12) HW 12 : page 138, 3, 4, 5, 6, 10, 11, 12, 15.

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