James Madison University
Department of Mathematics and Statistics
History of Computation – Math 615 Fall 2014

Online Course

Overview: Math 615 is a history of mathematics course, concentrating on the history of number systems, arithmetic, and the calculation of elementary functions like roots, trigonometric functions, exponentials and logarithms. The only prerequisite is basic algebra and a willingness to try and get to grips with what may be some unexpected approaches to familiar territory.

Goals of the Course:

1. Provide an overview on number systems through the ages.
2. Develop a more intimate understanding of elementary arithmetic through the use of many different tools and approaches.
3. Understand how elementary functions have been calculated in the past, and give a rough idea of how calculators evaluate expressions.
4. Provide students with introductory materials that may be useful as additional topics to be taught at the high school level.

Instructor: Dr. Stephen Lucas.

To contact me: In Person: Roop 112, Phone: 568-5104, Email: lucassk@jmu.edu.
While I understand that that the majority of you will not be able to come onto campus, I am perfectly willing to organize face-to-face meetings if you wish.

Textbook: *When You Run Out of Fingers and Toes: A History of Computation,* a draft textbook by myself. There are a wide range of general interest mathematics books concentrating on the history of mathematics, but this is the first that treats arithmetic and computation as a single topic. We will cover the entire text, and there will be opportunities to do independent web research on various topics.

Website: I will be placing lecture notes, videos, selected problem solutions and homework on Canvas as the semester progresses.

Lectures: Every week **from week two** of the JMU semester I will be placing three "lectures" on Canvas, the equivalent of three fifty-minute classes if we were to meet face to face. Each lecture is associated with sections of the text, and I highly recommend that you read the relevant sections of the text either before or after looking at my lectures.

Each lecture will be placed on Canvas in two formats. First, a straight pdf of the material I would put on the board during a face-to-face lecture. Second, a video of the same material, but this time with me stepping through it and talking over the top. While it won't be a full 50 minutes, I'll try and put in enough audio to make the text make more sense. Since you can't directly ask questions, it won't be as good as face-to-face. But, it may be better than simply reading the text, and you will have opportunity to pause, rewatch, or ignore at your leisure.

I have no preference on how you digest the lecture material, either spread out through the week or all in one lump, but I do request that you keep up with three lectures worth of material per week. Homework will be associated with each lecture.

Homework, Exams and Grading: Homework problems will also be assigned for each lecture, and need to be submitted through Canvas by the Friday of the following week. For example, the homework questions from the first three lectures (week 2) will be due by Friday of week 3, and so on. You can either write your solutions as an electronic document in the word processor of your choice, or write them with pen and paper and scan or photograph them. 30% of your final grade will be based upon your homework grades throughout the semester.

If you happen to be doing this course near others and wish to work in groups, I am perfectly happy for you to do so. The only request I make is that any homework solutions you submit are your own work, and that you don't simply copy other's work.

There will be a small project worth 15% of your final grade that will be your choice of topics on exploring a topic in the history of computation in more detail. This will be in the second half of the semester.

15% of your grade will be a midterm exam, and the last 40% will be a final exam. Both will be closed book exams, which will need to be proctored. If you are near Harrisonburg, I will be happy to do so at an agreed time and location. Otherwise, one of your colleagues or friends can act as a proctor. Exams will be somewhat related to homework problems, and I will allow you to bring a single sheet of paper into the exams with anything written on it you like. Coming up with a condensed summary of the course is excellent preparation for any exam.

Grades will be somewhat related to A≥90, B≥70, C≥60, but may vary depending on the class average and natural divisions between raw scores. Plus/minus grades will also be provided. Borderline cases will be decided based upon class participation, effort, and performance throughout the semester.

Getting Help: If you need help, ask! The worst thing you can do in a math course is let things slide. Luckily, the course is made up of a range of topics; don't assume that if you can't get a concept that you won't be able to get through the course.

Some random advice

- Read each section of the book either before or after the corresponding lecture, but always before you attempt the homework questions.
- Do the homework problems as soon as possible after the relevant class. If you have trouble, ask questions! I will be generous with hints.

- Graded homework will involve partial credit, and the majority of the marks will be for the working.
- Weekly submission of homework means you should work consistently through the semester. Don't just cram it all in a few days before a test. Try and spend roughly 5-6 hours a week on all aspects of this course.
- If you get a bad grade in a homework assignment, don't panic. Instead, get help, and take the time to work out what you missed.
- Math is about understanding, not memorizing. If you are memorizing a lot of things you may be studying the wrong way.

Proposed Math 615 Syllabus

Note that this is proposed. As I write the lectures for the course, there may be some variation. Follow what ends up on Canvas!

Week	Lecture	Content
2	1	Natural Numbers, Counters and Tally Sticks
2	2	Groups of Ten
2	3	Other Groups
3	4	Arabic & Chinese Rod Numerals, Other Bases
3	5	Varying Bases, Balanced Notation
3	6	Fractions, Greek & Egyptian
4	7	Fractions, decimal and other bases
4	8	Babylonian fractions, negative numbers
4	9	Irrationals, Reals, Scientific Notation
5	10	Addition and Subtraction using Counters
5	11	*Clearly, below moves up, some sections grow!*
5	12	
6	13	
6	14	Using Labeled Counters and Rod Numerals
6	15	Using Counting Tables and the Abacus
7	16	Addition and Subtraction Using positional notation
7	17	Other Bases and Varying Bases
7	18	Using Balanced Notation and Redundant Form
Spring Break Week depending on your timetable		
8	19	+/- fractions, decimals
8	20	Multiplication: squares, triangular, , doubling and halving
8	21	Using geometry, the counting table and rod
		numerals
9	22	Using positional notation
9	23	Napier's rods, Genaille's rods, modern.
9	24	Different Bases, Balanced and Redundant Form
10	25	Multiplying Fractions, decimals
10	26	Division by successive subtraction, doubling, geometry
10	27	Division using positional notation
11	28	Division for yielding decimals
11	29	Square Root, geometry, guessing, listing squares
11	30	Square Root, average to Newton's method
12	31	BB, high order, ENIAC
12	32	Digit by Digit, Infinite Series
12	33	Reciprocal Square Root, EDSAC, Goldschmidt
13	34	Building Trig Tables
13	35	Modern Methods for Trig
13	36	Logarithm history
14	37	Calculating logs
14	38	Formulas from Calculus
14	39	The exponential and arbitrary powers, the slide rule.