Department of Mathematics April 6, 2007

UNDERGRADUATE MATHEMATICS SEMINAR

This upcoming week's seminar will be on **Thursday**, **April 12** from 1:00-2:00pm in Bailey 201, with refreshments beforehand.

Please check the bulletin boards (and your email) for the announcement containing the name of the speaker, and the title and the abstract of the talk.

Pieces from Theses: A View from **Dan Stevenson** ('07)

For my senior thesis, I studied even perfect numbers. My final write-up contains several properties and characteristics of even perfect numbers and their corresponding proofs. To write and understand many of these proofs, I had to have a strong background in many of the topics in Number Theory. For example in one of my proofs I had to prove that all even perfect numbers were congruent to either 6 or 8 (mod 10). To do this I needed to know the theory of congruence and the basic properties of congruence.

As I built toward my formal definition of a perfect even number (an even number that equals the sum of its proper positive divisors) I had to introduce the Sigma function, which computes the sum of the positive divisors of a natural number. I then used several of the known properties of the Sigma function to complete my proof of Euclid's formula (a formula that is used to produce even perfect numbers). For completeness I presented proofs of these properties. To do so, I had to know how to write down all of the divisors for an arbitrary number. This required knowing how to express a number in its prime factorization and then using some mathematical intuition.

In addition, I also had to understand the notions of divisibility, greatest common divisors and two integers being relatively prime. I was then able to write all of my proofs using a combination of this background knowledge and simple algebraic manipulations that come from solving a variety of mathematical problems.

This experience not only left me with a better understanding of Number Theory, but it helped me with my proof writing and my writing in general. I had to write proofs in a number of different styles and I had to organize my work in a way such that each result builds on a past result. The trials and tribulations of organizing and proof reading a 20 page, (single spaced,) paper forced me to use previously learned writing skills and improve them.

The most important advice I can give to anyone planning on writing a math thesis in the future is to pick a topic that both interests and challenges you. The project will be a lot of work and will be much more enjoyable if you are researching a topic of interest. Also remember you are doing this project to learn new mathematics and the more challenging the topic is, the more there is to learn.

Resources for Students

- Stay in the Loop Not yet on the Math Department's email list? Do you want to receive news and announcements (the newsletter, seminar notices, etc.) electronically? Send an email to the department's secretary, Linda Jorgensen, jorgensl@union.edu, containing your year of

graduation and a request to be added to the list.

- Free Tutoring This term the Calculus Help Center will be open Sunday, Tuesday, and Thursday nights from 7:30 to 10:00. It is housed in Sorum House's seminar room. The tutors service all calculus courses through Math 115. Stop by for some help with your homework or your WebWork.
- Free Math Conference Look forward to next week's newsletter with information on this year's Hudson River Undergraduate Mathematics Conference, to be held at Siena College on April 21…

Problem of the Newsletter: April 6, 2007

Congratulations to Schuyler Smith for a submitting correct solution to last week's problem of the newsletter. You can view his solution on the bulletin boards in Bailey Hall.

Here is this week's problem: The results of the 2006 Putnam Exam are out! There were 3640 participants. The exam consists of two sets of six problems. Students have three hours for each set. As each problem is graded on a 0-10 scale, the maximum score is 120. However, as is typical, there were no perfect scores. The top score this year was 101, a fantastic score, especially considering that *fewer than 40% of the participants earned any points at all!*

Leave it to the Putnam folk, though, to present the scoring data in a somewhat tricky manner – which lends itself to a natural Problem of the Newsletter! The data below are the scores and the ranks from the 2006 exam. The rank for a given score is the average of the numerical places that score would occupy if the data were sorted and only one score put into each place. An explanation: The rankings of the top three scores are 1, 2, and 3. This indicates that one student scored 101, one student scored 99, and one student scored 98. The rank 4.5 assigned to the score of 92 indicates more than one student scored 92. In fact, 4.5 is the average of places 4 and 5, so we may conclude that *two* students scored 92.

Suppose Hugh R. Union answered one problem on the exam perfectly and earned a Putnam score of 10 points. How many people scored higher than Hugh, and how many people scored 10 points?

Professor Friedman will accept solutions to this problem until 12:00 noon Thursday, April 12.

Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
101	1	70	25	55	74	38	166	27	294	12	544
99	2	69	28	53	76.5	37	174.5	26	296	11	600.5
98	3	68	31.5	52	82	36	177	25	297	10	747
92	4.5	67	34.5	51	86.5	35	179	24	300	9	890
88	6	66	37.5	50	92.5	34	180.5	23	305.5	8	937.5
87	7	65	40.5	49	100	33	182.5	22	320.5	7	961
86	9	64	42.5	48	106.5	32	185.5	21	342.5	6	962
84	11	63	44	47	113	31.9	189.5	20	390.5	5	963
81	13	62	46	46	117	31.8	193.5	19	445	4	971
80	15	61	49	44	119	31.7	196.5	18	475	3	992.5
78	16	60	52	43	120	31.6	198	17	490	2	1089
77	17.5	59	56	42	122.5	31	208.5	16	492	1	1266.5
76	19	58	61	41	127.5	30	239	15	493.5	0	2501
73	20	57	65.5	40	140	29	266	14	501		
71	22	56	70.5	39	154	28	282.5	13	511.5		

2006 Putnam Exam Data