### TRIAL COURSE OR NEW COURSE PROPOSAL

**SUBMITTED BY:**

<table>
<thead>
<tr>
<th>Department</th>
<th>Mathematics and Statistics</th>
<th>College/School</th>
<th>CNSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by</td>
<td>Elizabeth Allman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Email Contact</td>
<td><a href="mailto:e.allman@uaf.edu">e.allman@uaf.edu</a></td>
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</tbody>
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**1. ACTION DESIRED**

<table>
<thead>
<tr>
<th>CHECK ONE</th>
<th>Trial Course</th>
<th>New Course</th>
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**2. COURSE IDENTIFICATION**

<table>
<thead>
<tr>
<th>Dept</th>
<th>MATH</th>
<th>Course #</th>
<th>F321</th>
<th>No. of Credits</th>
<th>3</th>
</tr>
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Justify upper/lower division status & number of credits:

This course is an elective for majors; three credits is appropriate for the content and depth of material.

**3. PROPOSED COURSE TITLE:**

Number Theory

**4. CROSS LISTED?**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>No</th>
<th>If yes, Dept:</th>
<th>Course #</th>
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</thead>
</table>

(Requires approval of both departments and deans involved. Add lines at end of form for such signatures.)

**5. STACKED?**

<table>
<thead>
<tr>
<th>YES/NO</th>
<th>No</th>
<th>If yes, Dept:</th>
<th>Course #</th>
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**6. FREQUENCY OF OFFERING:**

Fall semester even-numbered years.

(Every or Alternate) Fall, Spring, Summer — or As Demand Warrants

**7. SEMESTER & YEAR OF FIRST OFFERING (if approved):**

Fall 2010

**8. COURSE FORMAT:**

Note: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, any core course compressed to less than six weeks must be approved by the core review committee.

<table>
<thead>
<tr>
<th>COURSE FORMAT: (check one)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>X</th>
<th>6 weeks to full semester</th>
</tr>
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<tbody>
<tr>
<td>OTHER FORMAT (specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>lecture</td>
</tr>
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**9. CONTACT HOURS PER WEEK:**

<table>
<thead>
<tr>
<th>3 LECTURE hours/weeks</th>
<th>LAB hours/week</th>
<th>PRACTICUM hours/week</th>
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Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty/cd/credits.html for more information on number of credits.

**10. COMPLETE CATALOG DESCRIPTION including dept., number, title and credits (50 words or less, if possible):**

MATH F321 Number Theory. 3 credits. Offered Fall Even-numbered years.

The theory of numbers is concerned with the properties of the integers, one of the most basic of mathematical
Seemingly naive questions of number theory stimulated much of the development of modern mathematics and still provide rich opportunities for investigation. Topics studied include classical ones such as primality, congruences, quadratic reciprocity, and Diophantine equations, as well as more recent applications to cryptography. Additional topics such as continued fractions, elliptical curves, or an introduction to analytic methods may be included. Prerequisite(s): MATH 215 or permission of instructor.

11. COURSE CLASSIFICATIONS: (undergraduate courses only. Use approved criteria found on Page 10 & 17 of the manual. If justification is needed, attach on separate sheet.)

H = Humanities N = Natural Science S = Social Sciences

Will this course be used to fulfill a requirement for the baccalaureate core? YES NO

IF YES, check which core requirements it could be used to fulfill:
O = Oral Intensive, Format 6 W = Writing Intensive, Format 7 Natural Science, Format 8

12. COURSE REPEATABILITY:

Is this course repeatable for credit? YES NO

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit? TIMES

If the course can be repeated with variable credit, what is the maximum number of credit hours that may be earned for this course? CREDITS

13. GRADING SYSTEM:

LETTER: X PASS/FAIL:

14. PREREQUISITES

MATH 215 or permission of instructor

These will be required before the student is allowed to enroll in the course.

RECOMMENDED

Classes, etc. that student is strongly encouraged to complete prior to this course.

15. SPECIAL RESTRICTIONS, CONDITIONS

16. PROPOSED COURSE FEES

$0

Has a memo been submitted through your dean to the Provost & VCAS for

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously? Yes/No

If yes, give semester, year, course #, etc.:

18. ESTIMATED IMPACT

WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

None.

19. LIBRARY COLLECTIONS

Have you contacted the library collection development officer (ffk1j@uaf.edu, 474-
services available for the proposed course?  If so, give date of contact and resolution.  If not, explain why not.

[ ] No  [ ] Yes  UAF resources for this course are already adequate

20. IMPACTS ON PROGRAMS/DEPTS

What programs/departments will be affected by this proposed action? Include information on the Programs/Departments contacted (e.g., email, memo)

N/A

21. POSITIVE AND NEGATIVE IMPACTS

Please specify positive and negative impacts on other courses, programs and departments resulting from the proposed action.

Positive:  The Mathematics major has very few elective offerings for majors. This will strengthen the undergraduate curriculum. As two new faculty members will join the Department in fall 2009, there will be no negative impact on the Department’s service responsibilities or need for reallocation of faculty resources. This material may appeal to students in other disciplines such as CS too.

Negative: N/A

JUSTIFICATION FOR ACTION REQUESTED

The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

The addition of new courses to the undergraduate curriculum serves to improve the undergraduate experience for majors, or students earning a minor in Mathematics or simply interested in mathematics. The curriculum has been woefully weak on elective offerings because of short staffing in the department. This addition will greatly strengthen the Mathematics major, and introduce students to algebraic ideas and structures before taking the required course MATH 405W. In general, number theory has a broad appeal, including to students interested in cryptography.

APPROVALS:

Signature, Chair, Program/Department of: [ ] Date
Signature, Chair, College/School Curriculum Council for: [ ] Date
Signature, Dean, College/School of: [ ] Date
Signature of Provost (if applicable) Offerings above the level of approved programs must be approved in advance by the Provost. [ ] Date
<table>
<thead>
<tr>
<th>Signature, Chair, UAF Faculty Senate Curriculum Review Committee</th>
<th>Date</th>
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</table>

**ADDITIONAL SIGNATURES: (If required)**

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<th>Signature, Chair, Program/Department of:</th>
<th>Date</th>
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<th>Signature, Chair, College/School Curriculum Council for:</th>
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<table>
<thead>
<tr>
<th>Signature, Dean, College/School of:</th>
<th>Date</th>
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ATTACH COMPLETE SYLLABUS (as part of this application).
Note: syllabus must follow the guidelines discussed in the Faculty Senate Guide http://www.uaf.edu/uafgov/faculty/cd/syllabus.html.
The department and campus wide curriculum committees will review the syllabus to ensure that each of the items listed below are included. If items are missing or unclear, the proposed course change will be denied.

SYLLABUS CHECKLIST FOR ALL UAF COURSES
During the first week of class, instructors will distribute a course syllabus. Although modifications may be made throughout the semester, this document will contain the following information (as applicable to the discipline):

1. Course information:
   - Title, number, credits, prerequisites, location, meeting time (make sure that contact hours are in line with credits).

2. Instructor (and if applicable, Teaching Assistant) information:
   - Name, office location, office hours, telephone, email address.

3. Course readings/materials:
   - Course textbook title, author, edition/publisher.
   - Supplementary readings (indicate whether required or recommended) and any supplies required.

4. Course description:
   - Content of the course and how it fits into the broader curriculum;
   - Expected proficiencies required to undertake the course, if applicable.
   - Inclusion of catalog description is strongly recommended, and Description in syllabus must be consistent with catalog course description.

5. Course Goals (general) and Student Learning Outcomes (more specific)

6. Instructional methods:
   - Describe the teaching techniques (eg: lecture, case study, small group discussion, private instruction, studio instruction, values clarification, games, journal writing, use of Blackboard, audio/video conferencing, etc.).

7. Course calendar:
   - A schedule of class topics and assignments must be included. Be specific so that it is clear that the instructor has thought this through and will not be making it up on the fly (e.g. it is not adequate to say “lab”. Instead, give each lab a title that describes its content). You may call the outline Tentative or Work in Progress to allow for modifications during the semester.

8. Course policies:
   - Specify course rules, including your policies on attendance, tardiness, class participation, make-up exams, and plagiarism/academic integrity.

9. Evaluation:
   - Specify how students will be evaluated, what factors will be included, their relative value, and how they will be tabulated into grades (on a curve, absolute scores, etc.)

10. Support Services:
   - Describe the student support services such as tutoring (local and/or regional) appropriate for the course.

11. Disabilities Services:
The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials.
   - State that you will work with the Office of Disabilities Services (203 WHIT, 474-7043) to provide reasonable accommodation to students with disabilities.”
Instructor: John Rhodes
Office: 102 Chapman, 474-5445
E-mail: j.rhodes@uaf.edu
Office Hours: MWF 8–10, and by appointment
Web page: http://www.dms.uaf.edu/~jrhodes/MXXX.html
Prerequisites: Math 215, or permission of the instructor
Credit Hours: 3.0
Texts: Elementary Number Theory, 5th ed., by Kenneth Rosen
Class Meetings: MWF 10:30–11:30, in 410 Bunnell
Miterm Exam: Friday, Week 6 of the semester
Final Exam: Wednesday, December XX

Course overview and goals:

Number Theory is the branch of mathematics that studies properties of the whole numbers, or integers. It is one of the oldest areas of mathematics; one of the earliest books on the subject was written by Euclid. It is also one of the most active current research areas, with spectacular progress having been made over the past few decades.

This course will focus on Elementary Number Theory. The word elementary here is a technical one, meaning that only certain methods will be used, which seldom involve considering any numbers other than the integers. We will develop all the mathematical ideas from scratch, though you will notice many connections to the material in Abstract Algebra. (Other branches of Number Theory include Analytic Number Theory, in which calculus of real and complex functions provide the main tools, and Algebraic Number Theory, in which tools of advanced Abstract Algebra are used.)

Through most of history, Number Theory was considered to be the purest area of mathematics, known for elegant and appealing ideas, but with few applications. Nowadays, however, it is of great practical value, providing the source of almost all cryptographic methods in current use. Every time you use an ATM or place a credit card order on the Internet, number theoretic ideas are protecting you. As we progress through the theory, we’ll discuss some of these applications.

The core theoretical material of the course is in Chapters 3, 4, 6, 7, 9, and 11 of the text. We will also cover part of Chapters 5, 8, and 10 to explore some
applications, especially to cryptography. If time permits, we will go into topics in Chapters 12, 13, and 14. The organization of the last few weeks of the course will remain open, so that I can modify it according to students' interests. A likely topic is Elliptic Curves, which is both fascinating theoretically, and has grown in importance for applications recently. As this advanced topic is not covered in the text, handouts will be provided to supplement the lectures.

Mechanics of the course:

Class meetings will be run as interactive lectures. That means that while I will be presenting material at the board, and you should be taking notes, I will also be asking for suggestions, ideas, and questions about the material as we go along. I don't expect 'correct' answers, but I do expect you to be actively following and participating — that makes the class more interesting for us all.

Class attendance is expected, although I will not formally take roll. If you miss a class, you should get notes from another student. Homework assignments will be given in class, but also posted on the course web page soon after class is over.

Homework problems from the text will be assigned daily, and collected each Monday. As with any mathematics class, it is essential that you complete the homework to learn the material. Your homework will therefore be the basis for a significant portion of your course grade.

I encourage you to work with others on the homework, but you must write up solutions independently. You will learn nothing from simply copying someone's solution. Even though you may find you can't do every problem, you must make a reasonable attempt on them all.

You should begin your homework problems when they are assigned, so that if you have any trouble you can seek help during office hours.

Assignments are due by 5pm on their due date, either at my office or in my mailbox in the math department office across the hall. I will not accept any late homework that has not been cleared ahead of time or is not due to a genuine emergency (e.g., a death in the family, unexpected hospitalization).

Missed examinations or due dates that are not approved in advance will result in a zero grade on that exam or assignment. No make-ups will be allowed except in extreme circumstances (e.g., family death, documented illness, etc.). Notifying me by email or a note that you will miss an exam or due date is not sufficient for advance approval; you must speak with me to be excused.

Auditing of this course will only be allowed for those who agree to attend regularly, as evidenced by completion of midterm exams and most quizzes.

Grades:

Your performance will be evaluated based on 30% homework, 5% class participation, 30% midterm exam, 35% final exam.
Course grades will be determined according to the following cutoffs:

\[ A \geq 90\%, \]
\[ B \geq 80\%, \]
\[ C \geq 70\%, \]
\[ D \geq 60\%. \]

The top 3 points of each grade range will receive a ‘+’, and the bottom 3 points a ‘−’.

I reserve the right to move the cutoff points downward if particular exams turn out to be unexpectedly difficult. Note that you are not in competition with your peers – everyone in the class may get an A+, or everyone may get an F.

**University and Department Policies:**

Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams which can be found at [http://www.dms.uaf.edu/dms/Policies.html](http://www.dms.uaf.edu/dms/Policies.html).

If you have any disabilities that I should know about, you should bring them to my attention soon so that we can work with the Office of Disability Services to set up any necessary accommodations.

**Tentative Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–2</td>
<td>Integers, Primes, Greatest Common Divisors</td>
</tr>
<tr>
<td>3–4</td>
<td>Congruences and Applications</td>
</tr>
<tr>
<td>5–6</td>
<td>Cryptography, MIDTERM EXAM</td>
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<tr>
<td>7–8</td>
<td>Quadratic Reciprocity</td>
</tr>
<tr>
<td>9–10</td>
<td>Continued Fractions and Diophantine Approximation</td>
</tr>
<tr>
<td>11–12</td>
<td>Elliptic Curves (tentative)</td>
</tr>
</tbody>
</table>