

**MAT 321**  
**Main Topics for Test 1**  
**(Thursday, Feb. 23)**

**Miscellaneous Problem Types**

Be able to:

- find missing digits in UPC codes and ISBN numbers
- convert between ISBN-10 and ISBN-13 (EAN-13) numbers
- use congruences to analyze error detection properties of UPC codes and ISBN numbers
- use the Prime Number Theorem to estimate the number of primes up to  $x$
- use the greatest integer function to count the number of integers in a certain range that are divisible by  $d$
- find  $q$  and  $r$  in the Division Algorithm, and find  $a \bmod m$

**Proofs**

Be able to:

- prove facts about divisibility using the definition of "divides"
- prove facts about congruences using the definition of congruence
- prove (or disprove) that at least one number in a given list is always divisible by  $m$  (using the Division Algorithm to split the proof into cases)

**Special Algorithms**

Be able to:

- find the gcd of two (or more) integers and write it as a linear combination of the integers (both by hand and using Maple's **igcd** or **igcdex** commands), and find all ways to express the gcd of two integers as a linear combination of them
- find all solutions to a linear congruence (both by hand and using Maple's **msolve** command)
- find the inverse of a mod  $m$  (by hand and with Maple's **msolve** command)
- perform the efficient modular exponentiation algorithm (both by hand and using Maple's **&^ mod** command)

**Primality Testing**

Be able to:

- perform Fermat's Test (with Maple), and know when you can conclude a number is composite, when it is a pseudoprime, and when you can't make a conclusion
- perform Miller's Test (with Maple), and know how to determine whether an integer  $< 1.3$  million is prime or composite, and how to recognize a strong pseudoprime

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*To avoid losing your computer work during the test, restart your computer at the beginning of the test.*

*To print a copy of your Maple worksheet to turn in with your test:*

1. *make sure your name is on it,*
2. *after you print it, Dr. Spackman will retrieve it from the printer and deliver it to you at your seat.*