**Syllabus for CS111 Quiz 3**

**Topics:**

* The RSA
  + Explain the principle of public-key cryptosystems
  + Explain the RSA (initialization, encryption, decryption)
  + Suppose that Bob chooses p = 5, q = 11. Show some correct values of e (public exponent) and d (secret exponent). Give three correct pairs.
  + Bob uses P = (143,19) as his public key and S = 21 as his secret key. Is Bob's system correct?
  + Suppose Bob chooses p =7, q = 13, e = 11. Determine d. If Alice wants to send M = 10 to Bob, what is the ciphertext?
* Fermat's Theorem. Using the theorem to compute powers and inverses.
* Famous problems in number theory (state): Fermat's Last Theorem, Goldbach Conjecture, Twin Primes Conjecture, Primality Testing, Factorization, The Prime Number Theorem.
* Linear homogeneous recurrences equations
  + Give the recurrence relation for Fibonacci numbers. (Should also be able to prove that Fn grows exponentially with n.)
  + Setting up recurrence equations.
    - Example: One female rabbit produces 3 female rabbits per week, starting the 2nd week after its born. You receive one newly-born female rabbit for your birthday. How many female rabbits you will have after n weeks? (These are genetically modified female rabbits that do not need male rabbits for reproduction.)
    - Example: We tile an n-by-1 strip using 1-by-1, 2-by-1 and 3-by-1 tiles. Let tn be the number of such tilings. Give a recurrence for tn.
    - Example: Modify the last problem by allowing tiles of two colors, say red and green. Give a recurrence for the number of such tilings.
  + Solving linear homogeneous recurrence equations.
    - Example: Solve: fn = 5fn-1 - 6fn-2, with initial conditions f0 = 1, f1 = 2. Show your work.
    - Example: Determine the general solution of the recurrence hn = 5hn-1 -3hn-2 - 9 h n-3
* Linear non-homogeneous recurrences equations.