Mathematics s21 2007 - Day Seven

1. 9:00-10:20
   (a) Students present problems from homework.
   (b) N.B. In all the induction proofs that you do in this course, please state clearly what your base case is, what your induction step is, and what your induction hypothesis is.
   In pairs, read section 3.2, and do problems 3.2.2, 3.2.3, 3.2.4 and 3.2.5. Groups finishing early should start the problems from the 10:35-11:30 time slot. Groups finishing those should start the homework. Groups finishing that should put their heads down on their desks and rest.
2. 10:20-10:35 Break
3. 10:35-11:30
   (a) In same pairs, prove the following by induction.
      i. $\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$
      ii. For all natural numbers n, $4^n - 1$ is divisible by 3.
      iii. For all natural numbers n, $3^n \geq 2^n + 1$.
   (b) Groups present selected exercises.
4. 11:30-11:55 LaTeX
5. 11:55-1:00 Lunch
6. 1:00-3:00
   (a) In new pairs, read section 3.3 and do problem 3.3.2.
   (b) The Fibonacci sequence is defined as follows: $f_1 = 1$, $f_2 = 1$, and $f_{n+2} = f_{n+1} + f_n$ for all natural numbers n. Prove by complete induction that $f_{n+6} = 4f_{n+3} + f_n$ for all natural numbers n.
   (c) Groups present selected exercises.
   (d) Set Jeopardy!

Today's Key Ideas:
proof by induction
proof by complete induction

Homework

1. Prove by induction that $\sum_{j=0}^{n} 2^j = 2^{n+1} - 1$ for all natural numbers n.
2. Prove by induction that $5^{2n} - 1$ is divisible by 8 for all natural numbers n.
3. Prove by complete induction that $f_{n+5} = 3f_n + 5f_{n+1}$ for all natural numbers n. See above for definition of f_n.
4. Read section 4.1.