CS 173, Spring 2015
Examlet 7, Part A

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Use (strong) induction to prove the following claim:

Claim: For all integers a, b, n, $n \geq 1$, if $a \equiv b \pmod 7$ then $a^n \equiv b^n \pmod 7$.

Use this definition in your proof: $x \equiv y \pmod p$ if and only if $x = y + kp$ for some integer k.

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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Use (strong) induction to prove the following claim

Claim: $\sum_{k=0}^{n} p^k = \frac{p^{n+1}-1}{p-1}$, for all natural numbers n and all real numbers $p \neq 1$.

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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Use (strong) induction to prove the following claim:

Claim: $\sum_{j=1}^{n} j(j+1) = \frac{n(n+1)(n+2)}{3}$, for all positive integers n.

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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Use (strong) induction to prove the following claim:

Claim: $\sum_{j=1}^{n} \frac{1}{j(j+1)} = \frac{n}{n+1}$ for all positive integers n.

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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Use (strong) induction to prove the following claim:

Claim: $2^{n+2} + 3^{2n+1}$ is divisible by 7, for all natural numbers n.

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step:

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Use (strong) induction to prove the following claim:

Claim: $\sum_{p=1}^{n} 2(-1)^p p^2 = (-1)^n n(n+1)$, for all positive integers n

Proof by induction on n.

Base case(s):

Inductive hypothesis [Be specific, don't just refer to "the claim"]:

Rest of the inductive step: