DM HOMEWORK 7 (4 марта 2016 г.)

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Problem 1.
Let $P(n) = 5^n + 9 < 6^n$. $P(2)$ is true. Suppose that $P(k)$ is also true.
$P(k+1) : 5^{k+1} + 9 < 6^{k+1}$
$5^{k+1} + 9 < 5(5^k + 9) < 6(5^k + 9)$
$6(5^k + 9) < 6 * 6^k$
$5^k + 9 < 6^k$ is true by our assumption, that's mean that $P(k+1)$ is also true.

Problem 2.
Suppose all triplets of successive integers has sum less than 45. That's mean that if we divide all of numbers in triplets(of successive integers) in any way then we will get 10 triplets with overall sum of $450(45 * 10)$, but we know that sum of all integers in range from 1 to 30 is 465. It's contradiction and our assumption is wrong.

Problem 3.
$P(n) =$ product of n odd integers is odd.
$P(2)$ is true($(2n+1)(2m+1) = 2(2mn + n + m) + 1$). Suppose $P(i)$ is true for all $i < k$. Let's prove $P(k)$:
$(a_1 \dots a_l)(a_{l+1} \dots a_k)$. $(a_1 \dots a_l)$ is odd by our assumption $P(l < k)$. $(a_{l+1} \dots a_k)$ is also odd $P(k - l < k)$. And $P(2)$ is true.
Hence, $(a_1 \dots a_l)(a_{l+1} \dots a_k)$ is also true.

Problem 4.
It's not statisfies. $a_{k+1} = 2(k-1)^2 + k = 2k^2 - 3k + 2 \neq k^2$.