

Problem 2 (due on Monday, September 26)

Find all positive integers  $n$  such that  $n!$  divides  $(2n+1)^{2n}-1$ .  
(Here  $n!=1\cdot 2\cdot \dots \cdot n$  is the factorial of  $n$ ).

The positive integers in question are  $1,2,3,5,6$ . Our solution and the two submitted solutions all follow the same strategy: show that with a finite and small list of exceptions, the highest power of 2 which divides  $n!$  is larger than the highest power of 2 which divides  $(2n+1)^{2n}-1$ , hence  $n!$  can not be a divisor of  $(2n+1)^{2n}-1$ . The small number of exceptions is then handled by hand. For a complete solution and some additional problems and material see the following link [Solution](#).

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