

STEP III, 2015 , Q2

- 2 If s_1, s_2, s_3, \dots and t_1, t_2, t_3, \dots are sequences of positive numbers, we write

$$(s_n) \leq (t_n)$$

to mean

“there exists a positive integer m such that $s_n \leq t_n$ whenever $n \geq m$ ”.

Determine whether each of the following statements is true or false. In the case of a true statement, you should give a proof which includes an explicit determination of an appropriate m ; in the case of a false statement, you should give a counterexample.

- (i) $(1000n) \leq (n^2)$.
- (ii) If it is not the case that $(s_n) \leq (t_n)$, then it is the case that $(t_n) \leq (s_n)$.
- (iii) If $(s_n) \leq (t_n)$ and $(t_n) \leq (u_n)$, then $(s_n) \leq (u_n)$.
- (iv) $(n^2) \leq (2^n)$.



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