Mock IMO 1

1. Let $o(n)$ denote the number of odd digits in the decimal representation of n. Evaluate

$$\sum_{n=1}^{\infty} \frac{o(2^n)}{2^n}.$$

2. Triangle ABC is inscribed in circle ω. The tangent lines to ω at B and C meet at T. Point S lies on ray BC such that $AS \perp AT$. Points B_1 and C_1 lies on ray ST (with C_1 in between B_1 and S) such that $B_1 T = BT = C_1 T$. Prove that triangles ABC and AB_1C_1 are similar to each other.

   nonnegative

3. Given real numbers u, v, w with $u + v + w + \sqrt{uvw} = 4$. Prove that

$$\sqrt{\frac{uv}{w}} + \sqrt{\frac{vw}{u}} + \sqrt{\frac{wu}{v}} \geq u + v + w.$$

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