1. Fix $0 < \alpha < 1$. For integer $k$ let $m(k) =$ the number of distinct prime divisors of $k$. Show that for $\lambda > 0$ and $k \in \{n - n^\alpha, \ldots, n\}$, $\Pr(|m(k) - \log \log n| > \lambda \sqrt{\log \log n}) < \frac{1 + o(1)}{\lambda^2}$.

2. Prove that for every $\varepsilon > 0$ there is a finite $\ell_0(\varepsilon)$ and an infinite sequence of bits $a_1, a_2, \ldots$ such that for every $\ell > \ell_0(\varepsilon)$ and every $i \geq 1$ the two binary vectors $u = (a_i, a_{i+1}, \ldots, a_{i+\ell - 1})$ and $v = (a_{i+\ell}, a_{i+\ell+1}, \ldots, a_{i+2\ell - 1})$ differ in at least $(1/2 - \varepsilon)\ell$ coordinates.