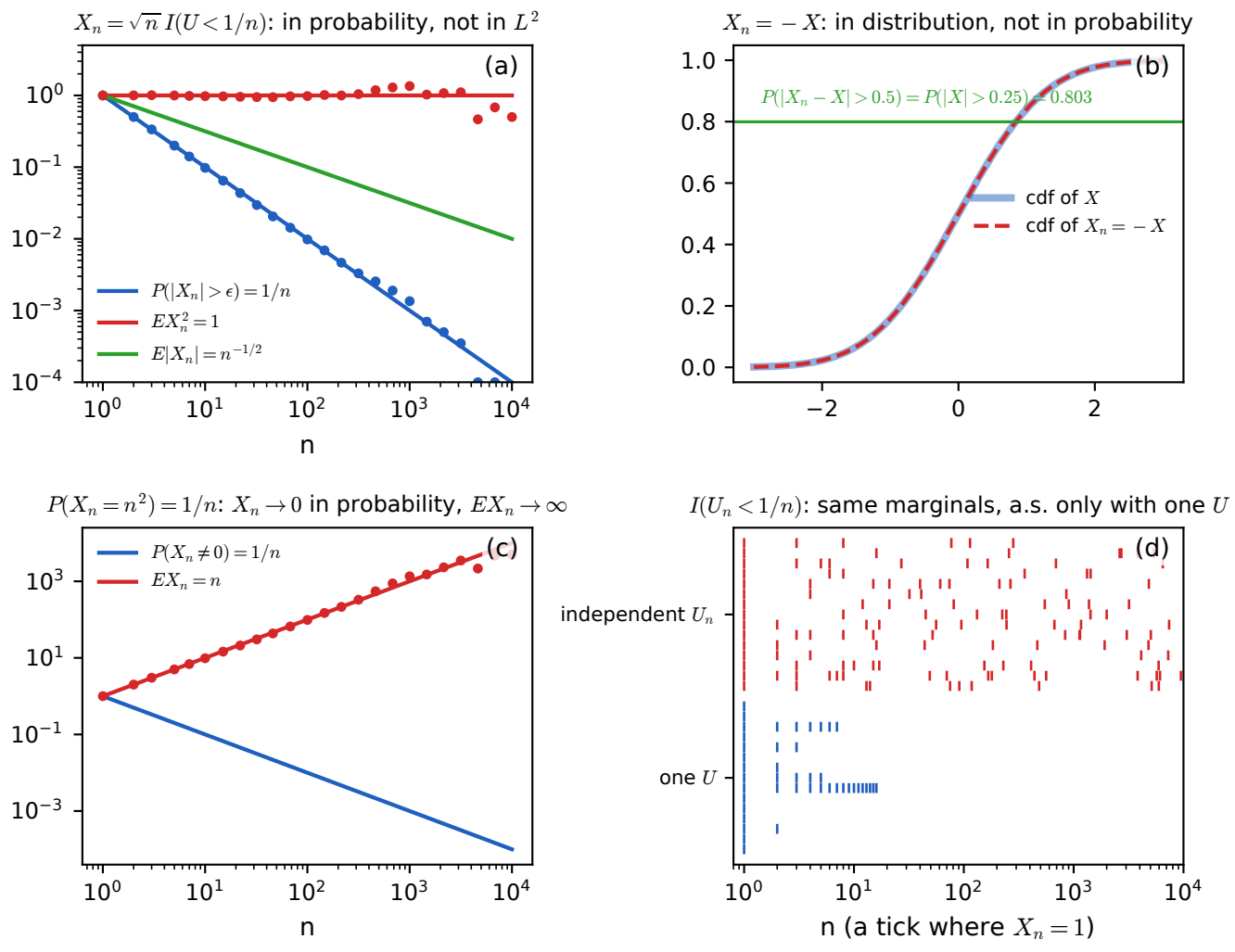

$X_n = \sqrt{n}\, I(U < 1/n)$: in probability, not in L^2
(a)
$P(|X_n| > \epsilon) = 1/n$
$EX_n^2 = 1$
$E|X_n| = n^{-1/2}$
n
$X_n = -X$: in distribution, not in probability
(b)
$P(|X_n - X| > 0.5) = P(|X| > 0.25) = 0.803$
cdf of X
cdf of $X_n = -X$
$P(X_n = n^2) = 1/n$: $X_n \to 0$ in probability, $EX_n \to \infty$
(c)
$P(X_n \neq 0) = 1/n$
$EX_n = n$
n
$I(U_n < 1/n)$: same marginals, a.s. only with one U
(d)
independent U_n
one U
n (a tick where $X_n = 1$)