Homework # 2. Extra problems.

Let $d_i(x) = 0, 1$ be the digits in the binary expansion of a number $x \in [0, 1]$. Define $r_i = 2d_i - 1$ and $s_n = \sum_{k=1}^{n} r_n$. Compute the following integrals:

$$\int_0^1 r_i(x)r_j(x)dx, \ \int_0^1 s_n(x)dx, \ \int_0^1 s_n^2(x)dx, \ \int_0^1 s_n^4(x)dx.$$