

Correct and fill in the details for the proof that for $\alpha < \beta$,

$$\lim_{n \rightarrow \infty} \mathbb{E}[F_{2,U}(\mathbb{1}_{[\alpha,\beta)})] = \int_{\alpha}^{\beta} \left[1 - \left(\frac{\sin(\pi u)}{\pi u} \right)^2 \right] du + \mathbb{1}_{[\alpha,\beta)}(0).$$