**Unit 3: Limits and Continuity - Week 1**

**Pset 3**
Due September 30 (4 points each)

(1) page 83:21
(2) page 94:10
(3) For step functions $s(x), t(x)$ defined on $[a, b]$ prove the Cauchy-Schwarz inequality:

$$\Big(\int_a^b s(x)t(x)dx\Big)^2 \leq \int_a^b s(x)^2dx \cdot \int_a^b t(x)^2dx.$$

Show that equality holds iff $s(x) = ct(x)$ where $c \in \mathbb{R}$.
(4) Bonus: Let $B = \{x \in [0, 1] | x = m/2^n \text{ for some } m, n \in \mathbb{Z}\}$ Prove that the function

$$f(x) = \begin{cases} 1 & : x \in B \\ 0 & : x \notin B \end{cases}$$

is not integrable on $[0, 1]$ by our definition of integrability.

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