- **1.** Find (with proof) an element of  $\mathcal{R}[a, b]$  that is not a uniform limit of step functions.
- **2.** Suppose  $l : \mathcal{P}(\mathbb{R}) \to [0, \infty]$  and that it is either finitely additive or that it is countably additive. Show that either  $l(\emptyset) = 0$  or  $l(A) = \infty$  for all  $A \in \mathcal{P}(\mathbb{R})$ . Regardless, show that *l* is monotone.
- **3.** Suppose  $l : \mathcal{P}(\mathbb{R}) \to [0, \infty]$ . Show that *l* is countably additive if and only if *l* is finitely additive and countably subadditive.
- 4. Carothers 16.4 (Read definition of outer measure  $m^*$  on page 269 first before attempting this problem and the following)
- **5.** Carothers 16.12
- **6.** Carothers 16.16
- **7.** Carothers 16.22
- 8. Carothers 16.24