11.1#2 Let $P = \{R_{ij}\}$ be any partition of the rectangle $R = [a,b] \times [c,d]$. Since $f(x,y) \equiv k$, we have

$$M_{ij} = \sup_{R_{ij}} f = k, \quad m_{ij} = \inf_{R_{ij}} f = k$$

for any i and j. Therefore,

$$U(P,f) = \sum_{ij} M_{ij}|R_{ij}| = k \sum_{ij} |R_{ij}| = k(b-a)(d-c),$$

$$L(P,f) = \sum_{ij} m_{ij}|R_{ij}| = k \sum_{ij} |R_{ij}| = k(b-a)(d-c).$$

Consequently,

$$\overline{\iint}_R f = \inf_P U(P,f) = k(b-a)(d-c),$$
$$\underline{\iint}_R f = \sup_P L(P,f) = k(b-a)(d-c).$$

Since $\overline{\iint}_R f = \underline{\iint}_R f = k(b-a)(d-c)$, by definition, f is Riemann integrable on R with $\iint_R f = k(b-a)(d-c)$.

11.1#6 Let $P = \{R_{ij}\}$ be any partition of the rectangle $R = [0,1] \times [0,1]$. For any i and j, since R_{ij} contains a point (x,y) with $x \in \mathbb{Q}$, we have

$$M_{ij} = \sup_{R_{ij}} f = 1;$$

similarly, since R_{ij} contains a point (x,y) with $x \notin \mathbb{Q}$, we have

$$m_{ij} = \inf_{R_{ij}} f = 0.$$

From this we find that

$$U(P,f) = \sum_{ij} M_{ij}|R_{ij}| = \sum_{ij} |R_{ij}| = 1,$$

$$L(P,f) = \sum_{ij} m_{ij}|R_{ij}| = 0,$$

and therefore

$$\overline{\iint}_R f = \inf_P U(P,f) = 1,$$
$$\underline{\iint}_R f = \sup_P L(P,f) = 0.$$

Since $\overline{\iint}_R f \neq \underline{\iint}_R f$, by definition, f is not Riemann integrable on R.