Which Spaces have UMP?

1. Identify whether the given subspace of $\mathbb{R}$ has the UMP, does not have the UMP, or whether you are unsure. If you give a definite answer, cite a theorem and/or explain; if you are unsure, say why the theorems don’t apply. (Avoid looking back at your previous answers!)

(a) $[0, 1] \cup \{2\}$

(b) $\bigcup_{n=1}^{s} \{n\}$

(c) $[0, 1] \cup [2, 3]$

(d) $[0, 1) \cup (2, 3)$

(e) $\{1\} \cup \{2\} \cup \{3\}$

(f) $[0, 1] \cup [2, 3] \cup [4, 5]$

(g) $[0, 1] \cup \mathbb{Q}$

(h) $(0, 1) \cup \mathbb{Q}$

(i) $\bigcup_{n=1}^{4} [n, n + 1/2]$

(j) $\{0\} \cup \{1\}$

(k) $\bigcup_{n=1}^{5} [n, n + 1/2]$. 
2. Create your own space $X$ with (or without) the UMP. Consider using sets like $\{1/n : n \in \mathbb{N}\}$ as part of $X$. 

$$\{1\} \bigcup_{n=1}^{14} [n, n + 1/2$$

(m) $\mathbb{R} - \mathbb{Q}$

(n) The Cantor Set

(o) $\bigcup_{n=1}^{\infty} [n, n + 1/2$