Consider the following graph $R_m$. This graph has $2m^2$ vertices. Each vertex is given by an ordered pair $(a, b)$ with $a \in \{1, 2, \ldots, m\}$ and $b \in \{1, 2, \ldots, 2m\}$. Two vertices $(a, b)$ and $(c, d)$ are connected by an edge if and only if they agree in one coordinate; that is, if $a = c$ or $b = d$. For example, $R_2$ is drawn.

(a) For what $m$ does $R_m$ have a Euler tour?

(b) For what $m$ does $R_m$ have a Hamilton cycle?